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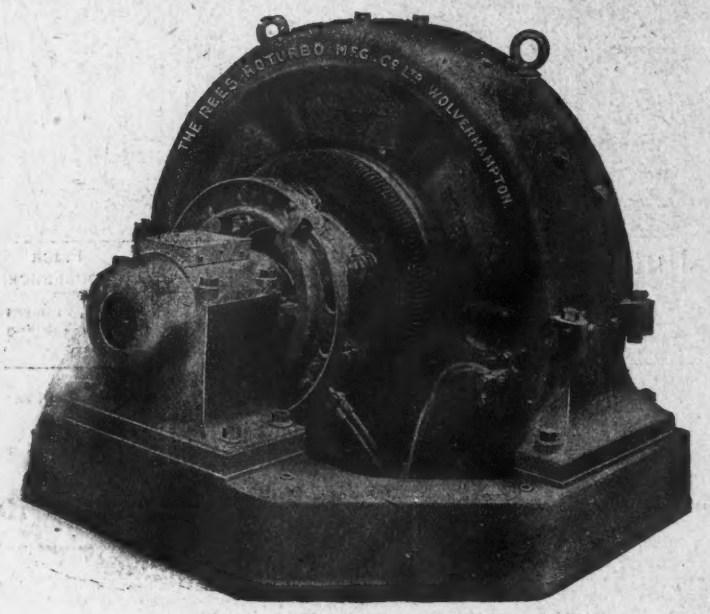

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ELECTRICAL REVIEW.

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THE I.M.E.A. MEETING.

IN our last issue we referred briefly to the annual meeting of this Association, which took place in London on Thursday and Friday last week, at the Institution of Electrical Engineers.

As was the case in the previous year, the proceedings were severely curtailed, though, judging by the numbers attending the meeting and the nature of the business transacted there, it is certainly open to question whether such drastic treatment of the annual gathering is not a mistake. If "public interest" is to be taken as a criterion, then the three papers considered on Thursday last week—which, so far as the authors' abstracts at the meeting are concerned, might equally well have been "taken as read"—deserved a better fate than to be crowded into one day, as they were devoted to pressing questions of the hour, of the first importance not only to the electricity supply industry, but also to the State, and might well have been discussed at greater length.

Mr. Lackie's paper dealt mainly with the arrangement and operation of the steam-raising plant in a modern coal-fired boiler house, though the discussion embraced several other topics and led to interesting disclosures on the subject of gas-firing. We confess that we were rather surprised that the paper contained no reference to the higher steam pressures and superheats, towards which developments in central-station practice have been tending for some time; fortunately, in the discussion, Mr. J. P. Gregory's intimation that a boiler-turbo unit of 1,500 KW. had been operating satisfactorily for over a year with steam at up to 400 lb. pressure and 700 deg. F. temperature, showing an overall thermal efficiency of over 19 per cent., afforded an indication that progress is being made by our engineers in this direction. The whole question of boiler pressures requires careful consideration now.

There appears to be no obvious reason why a factory for the commercial production of electricity should be rectangular in outline, any more than any other factory, and the care often displayed in fitting the boiler-house or houses to the modern turbine room is remarkable; we appreciate Mr. Selvey's remarks on this matter, though we cannot quite understand his apparent repugnance to gas-firing.

To us it seems that the suggestion of Mr. Christie, to separate the fuel plant from the modern boiler-house and treat it as a specialised department, has many points to recommend it.

It was unfortunate that Mr. W. Yorath Lewis, whose diagrams of Niclausse boiler plants were dis-

played upon the wall, was not called upon to speak until the sitting was about to close.

The paper by Mr. H. S. Ellis on independent stations *v.* bulk supply was criticised in some quarters because it was based on published statistics relating to works costs, &c., which are, of course, admittedly unreliable for certain purposes, such as, for instance, individual comparisons, but are, nevertheless, useful where average results of groups of stations are concerned. The future of the individual station is closely bound up with the question of interlinking supply areas, to which we have referred at some length in recent issues, and it is evident that if the highly efficient high-superheat plant referred to by Mr. Gregory is adopted to any extent, the life of the smaller generating stations as independent plants may be prolonged.

It is not at all unlikely, however, that linking-up may come about solely on the score of reliability, and, to turn to the third paper, by Mr. Kerr, on agricultural electricity supply, such linking-up in agricultural districts would probably be the means of developing a profitable load *en route*, from supply to farms, country houses, and villages in the vicinity of the line.

Mr. Kerr's paper is, we believe, the first one read in this country dealing specifically with the electrical aspects of agriculture from the central-station man's point of view, and draws timely attention to a matter in which we lag seriously behind many Continental nations, as well as the Canadians and Americans.

The paper recapitulates many matters which have, of course, appeared in the various articles on the subject appearing in our pages from time to time, and it is not now a question of whether electricity supply is valuable to the farmer and welcomed by him, or of whether it will pay the central station to supply the farmer, but solely a question of how to render such a supply available at an early date, in all reasonably accessible districts.

We have on previous occasions urged the pressing necessity of taking immediate action in this matter, the urgency of which is dictated alike by the favourable opportunity created by the present labour shortage, and by the need for checkmating the energetic campaign in favour of oil and petrol engines for farm work, which has already made considerable headway.

The discussion, though wholly favourable to Mr. Kerr so far as it went, rather tended to show that there are still many engineers and committee-men who are disposed to adopt a "Wait and See" policy. The achievement of practical results in the direction of agricultural electricity supply would obviously be facilitated were supply engineers—municipal and company alike, for the matter cannot be confined to municipal circles—to arrive at some common understanding as to the methods to be employed in installation work on farms, in running farm services, in formulating scales of charges, and generally in conducting this class of business; experience already gained should be within the reach of all, and no effort should be spared to secure both organised and standardised methods of dealing with the agricultural business. The matter is one on which it would be interesting to have the views of station engineers already engaged in this class of work, and an attempt should be made to secure the co-operation of the electrical and agricultural machinery makers. Possibly a society—or at any rate a committee—of representatives of all the interests involved might be formed to deal with these matters, and we should be happy to afford any assistance in our power towards attaining this end.

The Economic Pact.

The Prime Minister has announced in the House of Commons this week that if there is any general desire for discussion of the findings of the Allied Economic Conference he will find an opportunity therefor. While we must not attach too much importance to remarks that may fall in the course of a Parliamentary debate on this great subject, it would be of some value to see whether House of Commons opinion is as substantially sound on the matter as is opinion generally, and particularly in commercial circles, throughout the country. We heartily agree with those who say that there is no time to be lost in making such preparations as are necessary for carrying the Allied policy into effect. The French Cabinet has already signified the adhesion of the French Government to all the resolutions adopted, and Mr. Asquith has intimated that the result of the Conference is binding on the House of Commons. Each of the nations in the Entente will take steps suited to its own position and circumstances, but all are determined that both now and after the war they will not allow either their resources, their trade, or their people's interests to be exploited to the advantage of enemy countries or to the detriment of themselves. Of course, it is quite true, as some people have been saying, that the precise manner of dealing with the matter will be affected by the kind of peace that is secured. An inconclusive peace might leave much power in the hands of the Central Empires, limiting the ability of the Entente to carry the Conference's intentions into effect. But there is to be no inconclusive peace, and if Prussian militarism is to be stamped out the Prussian military party must be disposed of, or chained for generations. If the Allies' military and naval victory be so complete, as we believe it will, that there will be a break-up of Prussianism and a removal of its leaders from the head of German affairs, there will still be the commercial magnates and organisations to deal with. The break-up of the idol of World Domination may, as time passes, pave the way for new and better ideals among the millions of Germany, but the need will remain for those who, against their will, were plunged into this unparalleled war, to secure their position for the future, until the chastening of Germany has smashed the idol of commercial and industrial "penetration" and "domination." Therefore, it has been necessary to make these very definite recommendations for meeting the measures which the Central Empires are understood to be developing to defeat us all economically after the war. But the recommendations are to become more than mere recommendations. We observe that an attempt has been made to secure opinions in favour of a great gathering of industrial and commercial authorities to discuss how they should be carried into effect, but we doubt whether such a conference is either possible or desirable just now. The Government and the Board of Trade must know the mind of the country by this time on most of the points in the recommendations, and Mr. Asquith has promised to make "at an early date" a general statement as to the steps that are to be taken to give effect to the convictions so strongly expressed by the Conference. We await that statement with interest. There is no room for half-measures or for any half-hearted way of dealing with the matter. Step by step the Government has been assisted along a progressive way by the opinion of the majority of the nation, but we trust that Mr. Asquith's statement will show that the Cabinet needs no further pressure from the people, is of one mind, and ready for prompt, thorough, and energetic action in regard to these vital questions.

Mr. Asquith's promised statement is described as a "general" one. It will doubtless be sympa-

thetic and will deal chiefly with the main principles by which we are to be influenced in the carrying out of our policy; the manner of dealing with particular industries will be dependent upon the findings of the After-the-War Trade Committees which are now sitting. Mr. Runciman in his best moments said that Germany must be prevented from ever again raising her commercial "head." In later expressions of his views the "head" became only a Hunnish military "helmet." The Conference, at which he was unfortunately prevented from being present, seems to suggest the need for an economic straight-jacket to be fitted on to the enemy, only to be removed at the good pleasure of the Allies.

Lead.

THERE has been another considerable fall in the price of pig lead within the last few weeks which must be largely ascribed to the attitude of the authorities under whose control the market remains entirely as heretofore. The supply of spot or prompt metal has been throughout quite liberal, and offers of Government metal having at times been rather pressed, this has accelerated the downward tendency, which, moreover, has been lately assisted by the general depression in metals. The tendency, at the same time, has been very irregular, quite according to the extent of the demand from consumers for early delivery. The value of the latter has dropped to well below £30 a ton, and the fact is worth noting that forward positions have been obtainable at a steadily widening discount. Statistical data are now complete since supplies under Government control are no longer included in the official returns, so that these are of no use whatever in making attempts to gauge statistical merits. The authorities alone would be able to throw light on that point, or to what extent supplies are coming in or have been absorbed for munition purposes. Very big tonnages, no doubt, have been required in that direction, but there is good reason for believing that the authorities have already made full provision for all their requirements for some months to come. They are thus well able to accommodate consumers for current needs, and for this reason the sagging of prices is not unlikely to continue.

The efforts of the Government in getting prices down from an unduly inflated level have proved successful in the long run. There has been a severe fall from the highest seen this year, namely £36 10s., but prices still stand pretty high, making allowance that present indications as regards the course of the war lend themselves to a gradual return to more normal conditions. Unless a change of attitude becomes manifest on the part of the authorities, or arrivals unexpectedly fall far short of requirements, those dealers who are suggesting a recovery in values seem rather premature in their views. It is true that prices across the Atlantic are still at a high parity level as compared with our market, but there are now already vague signs of some American interests contemplating the placing of forward contracts for shipment to this side which may be regarded as the forerunner of a further letting down of prices in America. So long as America is still able to divert considerable quantities of metal to the Far East and elsewhere against old contracts entered into at high prices, no important development may be experienced in that quarter; but there is no doubt that with decreasing domestic requirements, American producers will soon feel the need of stimulating export business once more. Attempts in that direction would now probably be facilitated by the fact that exports from this country are still virtually prohibited, attempts made for some time past to obtain permits having proved abortive.

THE ECONOMIC PACT OF THE ALLIES.

THE representatives of the Allied Governments who met in June in Paris at the Economic Conference declare that the Empires of Central Europe are today preparing in concert with their Allies for an economic contest to continue after the re-establishment of peace. Agreements now under preparation between our enemies have the obvious object of establishing domination over the production and the markets of the whole world, and of imposing on other countries an intolerable yoke.

In face of this grave peril, the representatives of the Allied Governments state that they consider it their duty, on grounds of necessary and legitimate defence, to adopt and realise from now onwards all the measures requisite on the one hand to secure for themselves and for the whole of the markets of neutral countries full economic independence and respect for sound commercial practice, and on the other hand to facilitate the organisation on a permanent basis of their economic alliance. The following resolutions are therefore submitted for the approval of ourselves and our Allies, and in view of the unanimity of the conference, the definite nature of its propositions, and their importance as a basis for the preparation of a Government policy which shall be equal to the emergency, we print them in full. It behoves our own and the Allied Governments to proceed at once to embody the recommendations in Acts. The Conference, by its closing sentences, has declared that there must be no delay, and, though there will be tender-speaking voices and critical minds that will be all too solicitous for the interests of the enemy, we believe that the great bulk of the nation will be behind legislators if they take strong action immediately to ensure that the work of the Conference shall not be thrown away.

The recommendations relate to three periods:—(1) During the remainder of the war; (2) during the period of reconstruction, commercial and otherwise, in Allied Countries; (3) for after period (2) when permanent measures will be needed for mutual assistance and collaboration among the Allies.

Measures for the War Period.

I.—The laws and regulations prohibiting trading with the enemy shall be brought into accord. For this purpose:—

(*a*) The Allies will prohibit their own subjects and citizens and all persons residing in their territories from carrying on any trade with (1) the inhabitants of enemy countries whatever their nationality, (2) Enemy subjects wherever resident, (3) persons, firms and companies whose business is controlled wholly or partially by enemy subjects or is subject to enemy influence and whose names are included in a special list.

(*b*) They will prohibit the importation into their territories of all goods originating in or coming from enemy countries.

(*c*) They will devise means of establishing a system enabling contracts entered into with enemy subjects and injurious to national interests to be cancelled unconditionally.

II.—Business undertakings owned or operated by enemy subjects in the territories of the Allies will all be sequestrated or placed under control; measures will be taken for the purpose of winding-up some of these undertakings and of realising their assets, the proceeds of such realisation remaining sequestrated or under control.

III.—In addition to the export prohibitions which are necessitated by the internal situation of each of the Allied countries, the Allies will complete the measures already taken for the restriction of enemy supplies, both in the mother countries and in the Dominions, Colonies and Protectorates:—

(1) By unifying the lists of contraband and of export prohibition, and particularly by prohibiting the export of all commodities declared absolute or conditional contraband;

(2) By making the grant of licences for export to neutral countries from which export to enemy territories might take place conditional upon the existence in such countries of control organisations approved by the Allies; or, in the absence of such organisations, upon special guarantees such as the limitation of the quantities exported, supervision by Allied consular officers, &c.

Transitory Measures for the Period of Commercial, Industrial, Agricultural, and Maritime Reconstruction of the Allied Countries.

I.—The Allies declare their common determination to ensure the re-establishment of the countries suffering from acts of destruction, spoliation and unjust requisition, and decide to join in devising means to secure the restoration to those countries, as a prior claim, of their raw materials, industrial and agricultural plant, stock and mercantile fleet, or to assist them to re-equip themselves in these respects.

II.—Whereas the war has put an end to all the treaties of commerce between the Allies and the Enemy Powers, and whereas it is of essential importance that, during the period of economic reconstruction which will follow the cessation of hostilities, the liberty of none of the Allies should be hampered by any claim put forward by the Enemy Powers to most-favoured-nation treatment, the Allies agree that the benefit of this treatment shall not be granted to those Powers during a number of years to be fixed by mutual agreement among themselves.

During this number of years the Allies undertake to assure to each other so far as possible compensatory outlets for trade in case consequences detrimental to their commerce result from the application of the undertaking referred to in the preceding paragraph.

III.—The Allies declare themselves agreed to conserve for the Allied countries, before all others, their natural resources during the whole period of commercial, industrial, agricultural and maritime reconstruction, and for this purpose they undertake to establish special arrangements to facilitate the interchange of these resources.

IV.—In order to defend their commerce, their industry, their agriculture and their navigation against economic aggression resulting from dumping or any other mode of unfair competition, the Allies decide to fix by agreement a period of time during which the commerce of the Enemy Powers shall be submitted to special treatment and the goods originating in their countries shall be subjected either to prohibitions or to a special régime of an effective character.

The Allies will determine by agreement through diplomatic channels the special conditions to be imposed during the above-mentioned period on the ships of the Enemy Powers.

V.—The Allies will devise the measures to be taken jointly or severally for preventing enemy subjects from exercising, in their territories, certain industries or professions which concern national defence or economic independence.

Permanent Measures of Mutual Assistance and Collaboration among the Allies.

I.—The Allies decided to take the necessary steps without delay to render themselves independent of the enemy countries in so far as regards the raw materials and manufactured articles essential to the normal development of their economic activities.

These measures should be directed to assuring the independence of the Allies not only so far as concerns their sources of supply, but also as regards their financial, commercial and maritime organisation.

The Allies will adopt such measures as may seem to them most suitable for the carrying out of this resolution, according to the nature of the commodities and having regard to the principles which govern their economic policy.

They may, for example, have recourse either to enterprises subsidised, directed or controlled by the Governments themselves, or to the grant of financial assistance for the encouragement of scientific and technical research and the development of national industries and resources; to customs duties or prohibitions of a temporary or permanent character; or to a combination of these different methods.

Whatever may be the methods adopted, the object aimed at by the Allies is to increase production within their territories as a whole to a sufficient extent to enable them to maintain and develop their economic position and independence in relation to enemy countries.

II.—In order to permit the interchange of their products, the Allies undertake to adopt measures for facilitating their mutual trade relations both by the establishment of direct and rapid land and sea transport service at low rates, and by the extension and improvement of postal, telegraphic and other communications.

III.—The Allies undertake to convene a meeting of technical delegates to draw up measures for the assimilation, so far as may be possible, of their laws governing patents, indications of origin and trade marks.

In regard to patents, trade marks and literary and artistic copyright which have come into existence during the war in enemy countries, the Allies will adopt, so far as possible, an identical procedure, to be applied as soon as hostilities cease.

This procedure will be elaborated by the technical delegates of the Allies.

Whereas for the purposes of their common defence against the enemy the Allied Powers have agreed to adopt a common economic policy, on the lines laid down in the resolutions which have been passed, and whereas it is recognised that the effectiveness of this policy depends absolutely upon these resolutions being put into operation forthwith, the representatives of the Allied Governments undertake to recommend their respective Governments to take without delay all the measures, whether temporary or permanent, requisite for giving full and complete effect to this policy forthwith, and to communicate to each other the decisions arrived at to attain that object.

THE BENJAMIN ELECTRIC WORKS.

Recently, by the courtesy of the Managing Director, Mr. Guy Campbell, we were enabled to make tour of inspection through the works of The Benjamin Electric, Ltd., in Rosebery Avenue, E.C. The workshops, which were established seven years ago, have been continually extended until they now occupy the whole of the space available at this site, and are packed as full of machinery and workers as they can be—indeed, they are overflowing on to the roof, where a copper-depositing outfit is being installed. While the building is not ideally adapted for the purpose, the business has grown up in it and developed to its full capacity, and like the hermit crab, it is in need of a change of shell to provide more roomy accommodation—but that must wait until after the war; at the moment the works are so busy that the temporary disorganisation that would be incurred by making a change is out of the question.

The principal line of manufacture is, of course, the well-known Benjamin reflectors, but special types of lighting

Fig. 1.

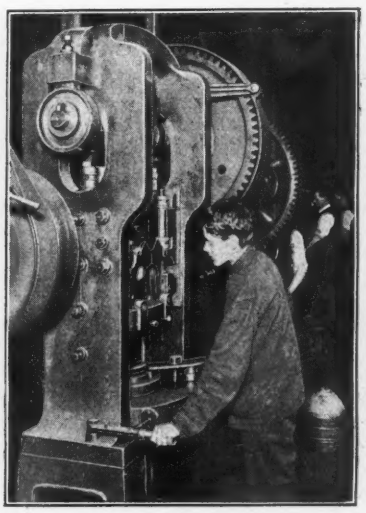

Fig. 2.

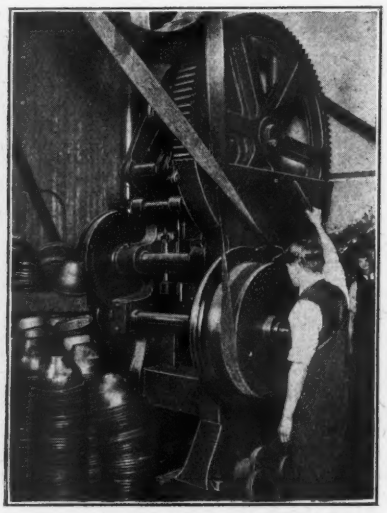

Fig. 3.

Views in the Benjamin Electric Works.

fittings, Goliath lampholders, large spinnings, &c., are important features of the company's products. The spinning of extraordinarily large vessels from sheet aluminium—sometimes as much as $\frac{1}{8}$ in. in thickness and 7 ft. in diameter at the commencement—is, indeed, a speciality of these works, and is rarely seen in course of execution in other factories.

These vessels, or tanks, are being made in considerable numbers for use in certain processes connected with the manufacture of munitions in which absolutely perfect

Fig. 4.—Experimental Laboratory.

freedom from leaking joints is necessary, so that spinning is the best method of production. At the time of our visit tanks about 2 ft. in diameter and 2 ft. deep were being made; they were beautifully finished, the surface of the metal being smooth, and the cylindrical shape of the vessel perfect. Spinning is an operation which demands not only a high degree of skill, but also very severe muscular effort on the part of the workman, who, in fact, when dealing with these large jobs, has to be assisted by a labourer; the spinner, moreover, is scarce, and, naturally, a good one can command high wages. Spinning is employed in the manufacture of certain types of Benjamin reflectors, especially those which are made of copper—though steel also is spun

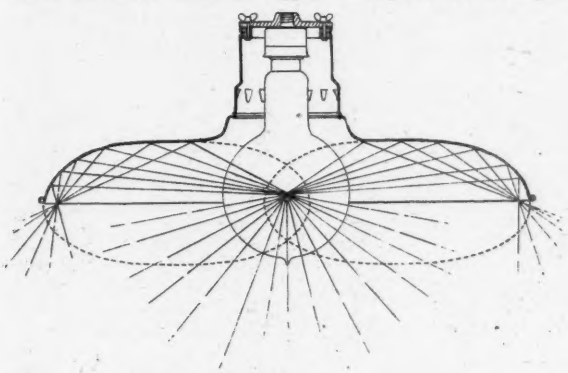

Fig. 5.—Diagram showing Optical Design of Distributing Reflector.

when required; other patterns are pressed out of the sheet, and, consequently, the spinning lathes, heavy presses, and annealing ovens form prominent features of the equipment. We give herewith a view in the spinning department (fig. 1), showing such work in progress, whilst fig. 2 shows one of the heavy power presses, fitted with safety control. A still larger press, which is used for drawing large and deep bowl reflectors, is illustrated in fig. 3 (back view). These presses were made by Messrs. Taylor & Challen, Ltd., and Messrs. J. Hands & Sons, of Birmingham, and are driven by electric motors. The heavy machines are all installed on the ground floor, together with the annealing stoves and enamelling ovens; enamel is applied by a pneumatic process, which results in an admirably smooth and uniform finish to the coating. A special aluminium enamel has been developed by the company, which when applied to the interior of a reflector gives high reflecting power, and at the same time prevents the steel from rusting, and is easily cleaned; as a rule, however, the reflecting surface is coated with white vitreous enamel, combining high reflecting efficiency with a sufficient amount of diffusion to produce a soft illumination.

An inherent feature of the Benjamin reflectors is that they are not simply "made," but are *designed*, on scientific

Fig. 6.—Benjamin Half-watt Reflector Fitting, Distributing Type.

principles, to produce particular results; and the achievement of the desired end is not merely presumed, but is definitely ascertained by actual trial. For these purposes a room has been set apart as an experimental laboratory, in which the designs of the reflectors are prepared and the result is afterwards tested photometrically. We illustrate in fig. 4 the interior of the laboratory, and in fig. 5 the method of arriving at the correct shape for a "half-watt reflector fitting," the final form of which is shown in fig. 6. This reflector is of the distributing type, and its radial

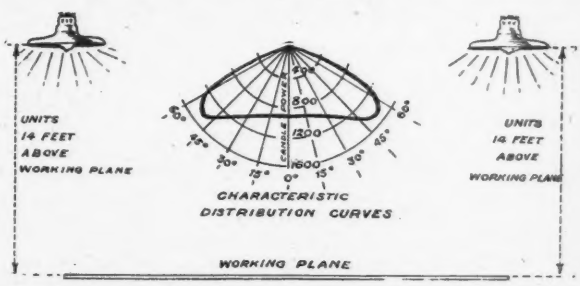

Fig. 7.—Characteristic Curve of Fitting, with Half-watt Lamp of 400 m.h.c.p.

section is part of a true ellipse, of which one focus coincides with the source of light; assuming the reflecting surface to be perfectly regular, all the rays emanating from one focus that are reflected from the surface must pass through the other focus, and the result is practically to produce a secondary light source in the form of a ring near the edge of the reflector.

The characteristic curve of distribution of light resulting from this design is shown in fig. 7, from which it will be

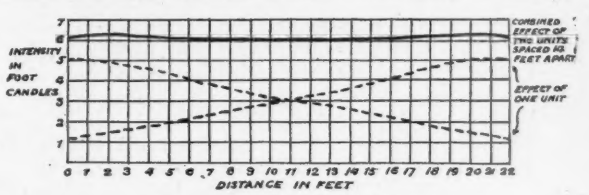

Fig. 8.—Illumination Curves.

seen that the intensity of illumination is greatly increased, especially at an angle of about 50° with the vertical. It is not sufficient, in lighting an area, to consider only the effect of a single lamp; the combined effect of all the lamps on each unit of area ought to be taken into account,

and this can be done by means of the curve. As a first approximation to the result, the illumination due to two adjacent lamps can be taken, and this useful information is given by the Benjamin Electric in connection with many of their reflectors, for stated conditions. For example, in fig. 7 two lamps are shown spaced 30 ft. apart and 20 ft. above the working plane; in fig. 8 are given the illumination curves for the space between the lamps, showing a remarkable uniformity of illumination, which will be preserved, but with different intensity, in all positions provided that the lamps are spaced apart (in this case) one-and-a-half times their height above the working plane. In addition to such information, the company include in their lists a variety of useful data, and a rapid method of calculating the wattage required to produce a given intensity of illumination.

Besides the distributing type of reflector above illustrated, a concentrating type is made, as well as a wide range of angle, intensive and extensive, cluster and other patterns, and a variety of lampholders and accessories. In particular, the porcelain Goliath screw lampholder, designed to take the place of the German lampholders with which the market was flooded before the war, has had an enormous sale; these holders are provided with a patent gripping device which effectually prevents the lamps from unscrewing, a great trouble in windy weather. The special machinery for making these and other accessories is installed on an upper floor, of which fig. 9 shows a section; and another floor is devoted to assembling the parts, as shown in fig. 10. In the tinman's shop special facia reflectors for shop windows were being made at the time of our visit, as well as a number of "daylight" fittings, provided with special glass light filters which, with half-watt lamps, give a light practically identical with daylight; we understand that this is a speciality of the Benjamin Electric. Special fittings for powder works, with deep spun copper reflectors, have been made in great numbers, the company having supplied them to many of the Government factories.

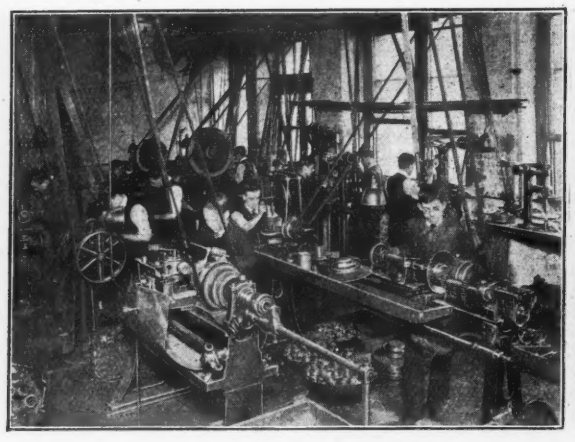

Fig. 9.—Part of Machine Shop.

Fig. 10.—Assembling Department.

While the company does no installation work, it has on many occasions designed schemes for lighting important areas, such as railway goods yards, &c., having acquired exceptional experience in such work, and is always willing to advise either purchaser or contractor; thanks to the system of scientific design combined with experimental verification, it is able to produce the desired results with certainty, and we were much impressed with the scientific methods of investigation that are practised in the laboratory. Moreover, although in the first instance the company marketed American products, almost the whole of its output is now produced in the shops in Rosebery Avenue, only a few items, for which there is a small demand, being imported. That the electric lighting industry has benefited greatly by the introduction of the types of reflector identified with the name of Benjamin cannot be gainsaid, and we congratulate the management of the company upon its success, which we hope will be maintained in the future also.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1916.—II.

On Friday morning last the concluding session of the meeting was held, to receive and discuss the Report of the Council and the Balance Sheet, and the Report of the Electric Vehicle Committee. Several passages in the Report gave rise to animated discussions, especially a proposal to end the impasse with regard to the Model General Conditions, some of which have been "receiving the consideration" of the Association of Municipal Corporations for nearly two years, by adopting the Model General Conditions of the I.E.E. Strong feeling was shown adverse to this proposal, and the matter was left *in statu quo ante*. The composition of the Council was another rather controversial matter, the discussion on which occupied a great part of the sitting; it was admitted that the engineers in charge of the big undertakings were men of ability and experience, but it was urged that those responsible for the smaller ones were not without merit, and as the small undertakings constitute the bulk of the membership, they should be directly represented in greater proportion than at present, a point which, to some extent, was ultimately conceded. The subject of British trade after the war called forth some excellent speeches in favour of the utter exclusion of enemy manufactures, a view which was heartily endorsed by the applause of the members. Little time was left for other questions, which were rapidly dealt with—including the report of the Electric Vehicle Committee, which was not discussed—and the meeting closed "in perfect harmony."

During the morning the result of the ballot for new members of Council was announced, as follows:—

President, Mr. F. M. Long. Senior Vice-President, Mr. S. J. Watson. Junior Vice-President, Mr. F. Ayton. Engineer Members: Messrs. J. Christie, S. T. Allen, and J. H. Bowden. Committee Members: Coun. Sinclair (Swansea) and Ald. Walker (Manchester).

The following is an abstract of the report of the Council:—The membership of the Association now stands at 377, made up as follows:—

Committees (Members)	168
Chief Electrical Engineers (Members)	172
Honorary Members	6
Chief Assistants (Associate Members)	4
Assistants (Associates)	27

Model General Conditions of Contract.—The British Electrical and Allied Manufacturers' Association expressed the hope that the I.M.E.A. would now recognise the Institution of Electrical Engineers' conditions as standard. The Council have, however, been unable to take any further steps in the matter, pending the receipt of the report of the Association of Municipal Corporations.

I.M.E.A. Bill.—At the suggestion of the B.E.A.M.A., joint meetings of representatives of the I.M.E.A., the B.E.A.M.A., and the Electrical Contractors' Association were held, at which it was believed that a complete settlement agreeable to all parties had been arrived at. After reference to the full Councils of the respective Associations, however, the E.C.A. finally declined to continue negotiations and decided to oppose the Bill so long as powers to sell are retained therein.

Eastbourne Accident and the Board of Trade.—The Council had had under consideration the report of the Electrical Adviser to the Board of Trade on the subject of the fatal accident which occurred on December 26th last, arising out of the collision of a motor car with a switch pillar. The Eastbourne Electricity Committee expressed a desire that the Council should approach the Board of Trade with a view to getting the recommendations contained in the above-mentioned report modified. The question is still engaging the attention of the Council.

Coal Supplies.—On the invitation of the Institution of Electrical Engineers, the Association appointed a representative (Mr. Chattock) to attend a national conference of representatives of the gas and electrical industries for the purpose of considering the question of coal supplies on May 6th, 1915. As a result of the deliberations a deputation of 34 representatives was appointed to present the case to members of Parliament, asking for their assistance in urging the Government to give effect to the recommendations passed at the meeting, calling for increased output, railway transit facilities, and proper regard to the requirements of public utility undertakings dependent upon their supplies on sea-borne coal, when requisitioning coal steamers.

Bailie Smith, a member of the I.M.E.A. Council, took a prominent part in the negotiations with the Coal Export Committee, and subsequently he was successful in getting an amendment made to the Price of Coal (Limitation) Bill, giving power to public utility undertakings to have the Bill made retrospective to include already placed contracts. Bailie Smith received the thanks of the Council for his valuable service. The whole question of coal supply as affecting members of the Association was referred to a sub-committee, with instructions to make recommendations and to assist members in any difficulty, with advice as to proper procedure.

In March, 1916, a summary of the report and recommendations of the sub-committee, which had been adopted by the Council, was communicated to the members. This was to the effect that while there had been, in many cases, serious difficulty in getting the necessary supply, there was a serious shortage in connection with a few undertakings only; the Board of Trade had, on February 7th, 1916, instituted Committees on Coal and Coke Supplies in 11 districts throughout the country, and the business of there Committees was to see that the resources of their respective districts were used to the best advantage, and that the requirements of important industries were fully met. The Association had approached the Board of Trade, urging them to restrict the exportation of small coal and to limit exportation to large bunker coal.

Since the District Committees had got to work it had become evident that they had very little power to obtain coal for public utility undertakings. Steps had therefore been taken to urge upon the Government the desirability of giving the Board of Trade powers to distribute coal where it was required, and to organise local coal for local use as far as possible, and so relieve congestion on the railways. It was also urged that more steamers should be provided to bring coal down from the North to the South of England.

The Council.—The Council elected Ald. Miller, of Croydon, a member of their body for the current year, and appointed Coun. S. Evans, of Sheffield, to fill a vacancy caused by the death of the late Coun. Crowther, of Sheffield.

The Council had had under consideration a communication from Mr. Purse, of Carlisle, making observations on the constitution of the Council, and some suggestions having for their object more particularly a definite representation of the smaller undertakings on the Council, and the substitution of a postal ballot for the present procedure whereby the ballot is restricted to those members attending the annual meeting.

The Council were of opinion that it would be unfortunate to draw any distinctions between members as representing the large or small undertakings or otherwise, and believed that satisfactory representation was gained under the existing Articles of Association.

British Trade after the War.—The Council had had before it the report of the Sub-Committee of the Advisory Committee of the Board of Trade on Commercial Intelligence, with respect to measures for securing the position, after the war, of certain branches of British industry, and after having given the report careful consideration unanimously passed the following resolution:—

"That this Council, while being anxious in every way to encourage British trade and the purchase of home manufactures, and being prepared heartily to support measures taken to this end by legislation or otherwise, view with deep concern recommendation 6 (*b*) of the Sub-Committee of the Advisory Committee on the Board of Trade to the effect that:

"'All Government Departments, local authorities and statutory bodies entrusted with the control of moneys raised by taxes or rates, should be under legal obligation to purchase, so far as possible, only goods produced within the British Empire.'

"The Council is strongly of the opinion that in the event of this recommendation being adopted, the interests of municipal electrical undertakings and their consumers—which latter embrace some of the largest manufacturing concerns in the country—will be seriously jeopardised, and that municipalities should in no way be subjected to any restrictions with regard to the purchase of plant and materials other than those imposed on private concerns."

Honorary Treasurer's Report.—The chief features of the accounts are a reduction in the cost of postages, printing and stationery, and in general expenses. The income from subscriptions remains stationary, and there is a decrease in the income from sales and advertisements derived from the proceedings. The net result is a surplus for the year of £77, as against £62 last year. The balance sheet shows a slight decrease in the liabilities and a surplus of assets over liabilities of £926.

Financial Organisation.—As a result of the Council having received a number of communications from engineer members intimating that difficulties were being experienced by them in efficiently managing the undertaking for which they were responsible, by reason of the systems of financial control adopted by the local authorities owning such undertakings, it was decided that the matter was of such importance as to warrant the appointment of a special sub-committee to consider the whole question and to report thereon. Mr. W. Wyld was requested to assume the duties of hon. secretary.

The Sub-Committee came to the conclusion that the difficulties experienced were not peculiar to electricity supply undertakings, but were common to all municipally-owned trading departments, and that the matter could better be dealt with by a joint committee composed of members of various interests concerned. To this end the co-operation of the Municipal Tramways Association (Incorporated), the Municipal Waterworks Association, and the Institution of Gas Engineers was invited, with the result that these bodies have appointed representatives to serve on a Joint Committee, and meetings of the Committee so formed are being held.

A request has been forwarded to all engineer members of the I.M.E.A. to submit to the hon. secretary of the Sub-Committee particulars of troubles which are being experienced by them in connection with the financial control of the undertakings with which they are connected.

REPORT OF THE ELECTRIC VEHICLE COMMITTEE.

The report states that *The Electric Vehicle* has been regularly brought out quarterly, and the Committee feels satisfied that it is proving a valuable means of educating the public as to the advantages of the electric vehicle for the different purposes for which it is specially recommended.

The Committee, jointly with representatives of the Tungsten Lamp Association, has considered the question of the sizes of bulbs, and the voltage, of incandescent lamps for use on electric vehicles. The result of the joint deliberation was the issuing of a recommendation that the standard voltage should be 12 volts, the lamps to be coupled across a section of six cells in a lead-plate battery or the equivalent number in a nickel-iron-alkali battery. It was recommended that the sizes of bulbs should be those fixed by the British Engineering Standards Committee in their Report, No. 69.

Standards have also been fixed for the overall sizes of cells, the rating for lead-acid electric vehicle cells, lead battery plates, inspection plugs, charging voltage, charging plug and receptacle.

The Committee has been in communication with representative electrical engineers in our Colonies with a view to the British Electric Vehicle Standards being adopted throughout the British Empire.

The Committee is again indebted to municipalities, electric supply companies, manufacturing firms, and others for financial assistance amounting to £142.

During the past year the following additional bodies have become represented on the Committee:—Garage Proprietors, Institution of Municipal and County Engineers, Municipal Tramways Association, Light Railways and Tramways Association, British Electrical Federation, Ltd.

Many new vehicles have been put into commission during the year, so that, at the present time, the estimate of vehicles in use in the United Kingdom is in the neighbourhood of about 680. This number includes 48 electric warehouse or works trucks, the use of which is likely to extend considerably in the near future; 33 municipalities operate between them, or have on order, 78 vehicles. The total number shows an increase during the twelve months of 197 vehicles.

The Committee thanks the hon. secretary, Mr. F. Ayton, for the very able and efficient manner in which he has handled the work of the Committee.

The accounts show a surplus of income over expenditure of £46, and a surplus of assets over liabilities of £141.

In the discussion on the Report of the Council, Mr. R. A. CHATTOCK suggested that the question of the Model General Conditions should be settled out of hand; it had been hung up by an instruction to the Committee, but he moved that the instruction be rescinded, and that the Model General Conditions of the Institution of Electrical Engineers be adopted provisionally for a year or two; they could be altered to suit individual cases. Mr. H. FARADAY PROCTOR seconded

the motion, but it was vigorously opposed by so many speakers that eventually it was withdrawn. In closing the discussion on this point, Mr. A. C. Cramb pointed out that the I.E.E. Conditions were designed to be fair to all parties, and not merely to aid the purchaser.

On the subject of coal supplies, Bailie Smith expressed gratitude to the Council for its action, which had resulted in a great saving.

The constitution of the Council was attacked by Mr. F. W. Purse, who called for the inclusion of members representing the smaller stations; various suggestions were made with a view to attaining this end, and finally a proposal of Mr. E. E. Hoadley, that at least one seat should be reserved for the representative of a town of less than 50,000 inhabitants, was adopted as a recommendation to the Council.

It was agreed that arrangements should be made for the adoption of a postal ballot for the election of the Council.

On the subject of British trade after the war, Mr. C. C. Atchison expressed regret at the attitude taken up by the Council, but said that luckily the Paris Conference had cut the ground from under their feet. He deplored the proposal that local authorities should not adhere to British machinery.

Ald. Walker moved a resolution urging the Government to take immediate steps to deal with the situation that would arise directly peace was declared; chaos would reign in the industrial world, the output capacity of manufacturing plant had been increased by 30 to 50 per cent., and local authorities' supply undertakings were dependent upon the maintenance of industrial prosperity.

Mr. Chattock seconded the motion, and Bailie Smith energetically called upon engineers to act for themselves instead of waiting for the Government to move; he hoped that no municipality would accept anything from enemy countries in the future. Another speaker agreed, holding that the Government should reverse its customary attitude and encourage trade, instead of neglecting it. Enormous assistance could be given in this way, and if it were done quickly there would be a trade boom after the war. The Chairman of the Kilmarnock Electricity Committee, in an able speech foreshadowing a victorious peace, said that it was the duty of the Association to support the Government in getting its house in order ready for that event. The country had been duped for years into assisting Germany to organise for war; they should urge the Government to put an embargo on all goods from enemy countries. A resolution on the foregoing lines was passed, and the Report and Balance Sheet were adopted.

The place of meeting next year was left to be settled by the President and Council.

On the motion of Mr. H. Faraday Proctor, a resolution pledging the Association to assist, with evidence and financially, the Hackney Borough Council in an action with reference to preferential charges was adopted.

Mr. A. B. Mountain, of Huddersfield, was elected an hon. member, and the proceedings closed with votes of thanks to the president and other honorary officers.

Boiler House Design and Operation.

By W. W. Lackie.

(Abstract.)

In the design of a modern boiler-house the main object has come to be to have the maximum of steaming capacity in the minimum of space. Twenty years ago, in the design of a generating station, it was a simple matter to install an additional boiler for each addition to the engine-room plant; economisers were seldom installed, and the stations were run non-condensing.

The growth in the demand for electric energy, the much improved load factor, and the introduction of the use of the steam turbine for the driving of electric generators about the year 1904, brought about a change in the relative space required for engine-room plant and boiler-house plant. Instead of having 1 h.p. per sq. ft. of engine-room floor space, we have to-day turbine rooms with 5 h.p. per sq. ft., and in designs for new power stations, using 15,000 to 30,000-kw. sets, this figure may go up to 20 h.p. per sq. ft. of engine or turbine-room floor space.

It is now recognised that even with improvements in boiler-house design, where very large turbo-generators are in use, every pair of such sets requires a separate boiler-house. Several present-day power houses have an evaporation of 50 lb. of water from and at 212 deg. F. per sq. ft. of ground space occupied by the boilers, but it is possible with improved design of the boiler-house plant to approach an evaporation of 100 lb. from and at 212 deg. F. per sq. ft. While the engine-room and boiler-house floor space were 20 years ago about equal, and remained so even for 10 years thereafter, to-day in a large modern generating station the ground space occupied by the boiler-house is from 1½ to 2½ times the space occupied by the turbine-room.

It is now recognised that a modern boiler-house should consist of three storeys at least: the basement or ground floor containing ash-handling plant; the second floor containing the boilers proper, and the third or upper floor containing economisers and coal-conveying machinery, and probably coal storage.

In stations where boilers of 50,000-lb. capacity are installed, it is necessary to erect a separate chimney for each boiler or each pair of boilers. One is practically compelled to adopt steel in preference to brick for chimneys in a modern boiler-house, as with steel the chimney can be erected from the third floor, on which the economisers are placed, whereas if brick is used the foundations and superstructure up to the second floor simply mean a waste of valuable space and a mass of brickwork which serves no useful purpose.

The space actually occupied by boilers at present, with the necessary passages between them, does not as a rule exceed 33 per cent. of the total boiler-house floor space, and of this 33 per cent. the grate area only accounts for one-half.

Let us consider the case of a boiler-house which has to supply steam to two 15,000-kw. sets. The steam required for each set will amount to between 180,000 and 200,000 lb. per hour. This steam under modern conditions would be supplied by four boilers, each capable of generating 50,000 lb. of steam. Each boiler will require to burn at least 7,000 lb. of coal per hour, depending upon the calorific value of the coal. Grates of 250 to 270 sq. ft. will be necessary, which means that each boiler will actually occupy, with passages between, about 500 sq. ft., eight boilers will require 4,000 sq. ft., and the boiler-house will have a floor area of 12,000 sq. ft. Fig. 1 shows a plan and cross-section of such a boiler-house.

Twenty years ago water-tube boilers of 4,000 to 6,000 sq. ft. heating surface were considered large; to-day boilers are made with a heating surface from 10,000 to 20,000 sq. ft. In Detroit five boilers each with over 20,000 sq. ft. heating surface are in use.

The boiler-house should be designed to admit of an ample supply of natural daylight. This is managed by placing the boilers back to back, with a firing floor down each side instead of down the middle between the two rows of boilers. Light can then be had from windows in the side walls as well as from the roof. This, however, means a larger floor area and a space between parallel boiler-houses, and further increases the area occupied by the power station. Adequate daylight can be got from roof lights with proper design of the roof, and fig. 1 shows such an arrangement.

There is still a tendency to-day to construct the combustion chamber of boilers much too small. A combustion chamber should be of such dimensions as to allow ample space for complete combustion to take place and the products of combustion thoroughly to mix before coming on to the heating surface. The older boilers had 2 to 2½ cu. ft. of combustion chamber per sq. ft. of grate area; to-day similar

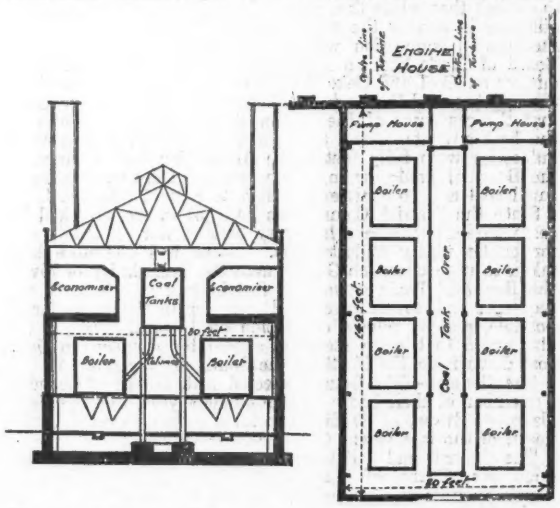

Fig. 1.—Sectional Elevation and Plan of Boiler-house.

boilers have 5 cu. ft. The Detroit boilers before referred to have 9 cu. ft. per sq. ft. of grate area, and this fact is very largely responsible for the high efficiency of these boilers at widely varying loads.

Steam flow meters are as necessary on boilers as an ammeter is on a generator, as they indicate what each boiler is doing, and whether all the boilers are doing their fair proportion of the work.

CO_2 recorders are an index of the working efficiency of the boiler-house; a word of warning, however, is required against assuming that high CO_2 always means high efficiency. There may be a large quantity of CO present. There should be thermometers or pyrometers with dial faces on every boiler, giving the temperature of the superheated steam leaving the boiler, also the temperature of the gases at the damper.

We may at an early date see an increase in the boiler pressure from 160 and 200 lb. to 250 lb. The Commonwealth Edison Co., of Chicago, in 1910 adopted 250 lb. at their North-West station.

A station of 50,000 kw. capacity and burning 200,000 tons of coal per annum requires coal-handling facilities for a supply of 1,000 tons of coal per day, together with facilities for handling 100 tons of ashes per day. This means a railway siding capable of holding from 100 to 200 full trucks, and probably another siding of equal dimensions to hold the

empty trucks. The length of railway sidings for a 50,000-KW. station would not be less than half a mile, or an addition to the site equivalent to 4,400 sq. yd. The wagons have to be tipped, and coal-conveying plant has to be provided capable of handling 200 tons per hour. Coal-breaking machinery should be installed, for while we have been in the habit of using small coal, circumstances may in the near future render it economical to buy and break larger coal.

Large coal storage accommodation is advisable and will prove economical; not less than from two to four months' fuel supply should be retained. This margin enables coal to be delivered in fairly regular quantities throughout the year, and may result in lowering coal prices.

The cost of energy for lifting coal from canal barges or from trucks, and placing it overhead in coal hoppers or in the coal store, is a small item. In one Glasgow station we have a coal transporter fitted with a one-ton grab. This transporter cost £2,600, and handles coal at the rate of 40 tons per hour; the cost of energy, labour, and repairs brings the cost of handling coal in this way just under 1d. per ton. In another station truck-loads of coal are elevated 30 ft. at one end of the coal store to an overhead platform, whence the coal is tipped into an overhead hopper or to the coal store, and the empty trucks are lowered by a second elevator at the other end of the coal store. These two elevators, complete with electrically-operated capstans, cost £2,000. The inclusive cost of handling coal in this way is 3½d. per ton, the higher cost being due to the amount of labour necessary for handling the trucks. These figures are conclusively in favour of the grab and transporter. Where coal has to be carried a short distance from coal store to boiler-house, bucket or tray conveyors appear to be the right thing. On the other hand, for longer distances, the telpherage system works out slightly cheaper.

For the removal of ashes, bucket conveyors have proved to be costly in upkeep on account of the wear of the axles and pulleys, caused by the fine hard grit of ash dust, but even with this drawback, bucket or tray conveyors seem to be the cheapest method of removing ashes. Suction ash plant is finding much favour on account of the absence of moving parts in its design, but the capital cost is about three times that of bucket conveyors. The cost of energy for operating suction ash plant works out at about 5d. per ton handled, at 1d. per unit. Suction plant is now made to do other work. It can be constructed for the purpose of elevating riddlings and small unburned fuel to a hopper or tank over the coal-conveying plant. It can also be made suitable for the removal of soot from economiser soot chambers, and flue dust from the base of the chimneys.

A modern boiler-house calls for comparatively large overhead ash storage, from which ashes can be dropped into wagons or other vehicles for removal. The removal and disposal of ashes is becoming a serious matter. A few years ago ashes had a market value, and we could get as much as 4d. or 5d. a ton for them; to-day we have difficulty in getting the ashes from our stations carted away at 2s. a ton. It has been suggested that it would pay the large electrical undertakings to purchase 3-ton or 5-ton electrically-propelled wagons for the removal of ashes, especially where convenient railway facilities are not available.

Coal-weighing machinery for each boiler or group of boilers is absolutely necessary if proper records are to be made of the boiler-house efficiency. It should always be possible to ascertain the amount of coal used in each eight-hour shift and at the end of each week or month, so that the coal used per KW.-hr. generated may be ascertainable. These weighing machines should preferably be fixed between the overhead coal hopper and the boiler stoker, but some stations in America have a travelling gantry, fitted with a weighing machine at each end, the gantry travelling along the whole length of the boiler-house between two rows of boilers. The duty of the operator on this gantry is to move up and down the boiler-house and to weigh out regularly to each boiler a predetermined amount of fuel.

The total condensate from the turbine-room condensers should be measured by a Lea or other water recorder, and this should have an integrating attachment. Having ascertained the amount of coal used and having measured the condensate, we can get the amount of water evaporated per lb. of coal used.

No very great increase in the efficiency of steam boilers can be looked for. The heat balance of many of the steam plants in operation at the present day is as follows:—

Heat absorbed by boilers	78 per cent.
Heat lost in flue gases	15.5 per cent.
Heat lost in radiation and unaccounted for	6.5 per cent.

That is to say, the total loss on which any reduction can take place is 22 per cent., but it is only a small proportion of this figure which can be attacked with a view to lowering it. It would be doing negative work to discharge the gases from a boiler at a temperature lower than that of the water in the boiler.

An evaporation of 4 lb. of water per sq. ft. of heating surface in the boiler was, until recently, considered standard practice, but to-day water-tube boilers are designed, in conjunction with special economisers, to evaporate at the rate of 6 lb. normal load, and at overload 8 and even 10 lb. per sq. ft. of heating surface of the boiler. The heating area in most water-tube land boilers is of the order of 50 times the grate area. With such proportions the general practice is to emit the gases from the boilers at a temperature of 500 deg. to 550 deg. F., *i.e.*, from 100 to 150 deg. F. above the temperature of the steam at the boiler working pressure. The proportion of heating surface in economiser to heating surface in boiler varies, but 35 per cent. may be taken as a fair average. With such a proportion, allowing for heat drop in flues, the gases at the outlet to the chimney will have a temperature of from 325 deg. to 350 deg. F., and the economiser will have utilised about 7 per cent. of the heat of the gases emitted from the boiler. The inlet water to the economiser from the hot-well will, with present-day practice, be raised to a temperature of 200 or 220 deg. F. Until recently the evaporation per sq. ft. of heating surface of boiler and economiser combined was therefore roughly 3 lb. per sq. ft. of heating surface. Modern practice tends to diminish the heating surface in the boiler from 50 times the grate area to 35 times the grate area and to increase the area of the economiser to 80 per cent. of that of the boiler heating surface. The result is to put up the evaporation of the boiler at overloads to 8 lb. per sq. ft. of heating surface and the temperature of the gases now emitted from the boiler is considerably raised, being about 650 deg. F. The heat, however, is taken up in the economiser and the temperature of the feed water to the boiler is considerably increased. The net result is that we get an evaporation of 4½ lb. per sq. ft. of heating surface of boiler and economiser combined. The overhead economiser is suitably proportioned to give the very highest combined efficiency. Boiler plants arranged in this way probably give a higher efficiency than was the case with previous designs, inasmuch as the radiation losses are less and the loss between the boiler and the economiser is reduced to an absolute minimum.

(To be concluded.)

WAR ITEMS.

Lighting Prosecution.—For allowing light from unscreened lamps to shine through four windows and the door of the boiler-house at the electricity works at Middleton (Lancs.), James Faulkner, of Oldham Road, Middleton, was last week fined 7s. A police officer said that when he saw defendant about the matter, he said the windows and door were opened for about an hour on Thursday nights to allow of ventilation while the boilers were swept out.

To be Wound-up.—The Board of Trade has ordered the following to be wound-up:—

Eiermann & Tabor, Lauderdale Buildings, Aldersgate Street, London, E.C., bronze powder and metal leaf manufacturers. Controller: P. W. Straus, 7, Great Winchester Street, E.C.

The Bakelite Co., Ltd., Orb Works, Cowley, Middlesex, makers of insulating material. Controller, Sir W. B. Peat, 11, Ironmonger Lane, E.C.

Griesheim-Elektron, Ltd., 3, Thames House, Queen Street Place, London, E.C., and Salford, merchants in dyestuffs and chemicals. Controller: W. Eaves, 15, Fountain Street, Manchester.

Exemption Applications.—An application for exemption made by Mr. E. Inkpen (36), electrician, of Camberley, has been refused.

At Exeter, Mr. F. T. Baker, electrical engineer, who has lost five of his staff and an apprentice, was given exemption until November 30th.

Hastings Tribunal has given conditional exemption for three months to Mr. A. Tester, electrical contractor, and Mr. R. Merrifield, repairer of electrical plant, with Mr. Wordley.

By arrangement with the military, the Reading Corporation Tramways Committee has decided to release for military service all motor-men under the age of 27, and to retain the rest. Sixty per cent. of the staff have enlisted, and the pre-war staff of 200 has been reduced to 84, 47 of whom are being taken for the Army.

On the appeal of Mr. J. T. Spencer, conditional exemption has been granted by the Reading Tribunal to G. P. Wilkins (29), electrician.

At Northampton, on Monday, the Electric Light & Power Co., Ltd., appealed for eight of 15 employés recently unbadged by a Government Inspector. It was stated that the pre-war staff consisted of 77 men and 10 boys; now there were 71 and 16 respectively, but the heavy demand for power for factories had increased the output by 55 per cent. Temporary exemption was allowed in each case.

Exemption has been allowed to Mr. J. W. Gibson (30), manager of the Holsworthy Gas & Electric Supply Co.

The Leigh (Lancs.) Tribunal has granted one month's temporary exemption to the electrician at a local picture house.

At Oldham, exemption was granted to the attendant and electrician at the Castleshaw filtration works on the application of the Corporation waterworks engineer.

At Salford, an electrical contractor appealed for a wireman—his brother—aged 19, and said he had only three men left, including himself. He was indispensable to the business, and applicant had written to the Ministry of Munitions, but had not yet received any reply. The appeal was adjourned for a fortnight so that the decision of the Ministry of Munitions might be obtained.

At Reigate, Messrs. Tamplin & Makovski, electrical engineers, appealed for a foreman, fitter, and turner, an electrical engineer, a maintenance engineer, an engineer, a foreman and skilled hand, and a skilled wireman. It was stated that the firm had lost 18 of their permanent staff. The foreman fitter and turner, the foreman and skilled hand, and the maintenance engineer were conditionally exempted; the engineer was directed to be medically examined, and the other cases were dismissed.

The Maidenhead Tribunal has granted exemption until October 1st to A. R. Mills (21), engine driver and stoker, and Geo. Arthur Cox (22), shift engineer, engaged at the Corporation electricity works.

Leyton Tribunal has granted conditional exemption to nine employés at the destructor works of the U.D.C. The staff has been reduced from 25 to 17.

Six months' exemption has been granted at Hemel Hempstead to Mr. F. Bishop, electrician, of Cotterells. Mr. Bishop was invalided from the Naval Service, and is now certified fit for home garrison duty.

At Rochdale, exemption was claimed by Mr. G. L. Adamson for W. Bentley (22), electrical wireman, engaged on work directly affecting Government contracts. Mr. Adamson said that 50 per cent. of the employés had been lost. Twenty-one days were granted.

As the result of appeals at Epsom, Mr. F. Fairs, estate electrical engineer, of Stoke d'Abernon, has received exemption until June 30th; Mr. H. J. Proctor, electrician, of Cobham, until September 30th; and Mr. E. E. Newbald, electrical engineer and contractor, of Epsom, for three months.

On the appeal of the Woking Electric Supply Co., Samuel Chas. Bicknell (37), wireman and repairer, has been exempted for three months, and Philip S. White (39), cable jointer's labourer, for one month.

Mr. J. S. Mander (32), assistant engineer with the Ascot and District Electrical Co., has been granted a month's exemption, until July 15th. It was stated that it had been found impossible to fill Mr. Mander's place, and that, alternately with another employé, he had charge of the generating machinery.

Hertford Tribunal has granted exemption until September 30th to Mr. A. H. Sharrat, electrical engineer.

Mr. Lambert applied to the Maidstone Tribunal on behalf of the Corporation for the exemption of Mr. J. P. Macrow (29), electrician, regarded as indispensable to the tramways system, and conditional exemption was conceded.

The Blackpool Tramways Committee has given instructions to the manager to apply to the Tribunal for exemption till the end of the season for a dozen motor-men. It has been found impossible, Mr. Furness informed the Committee, to secure suitable men of non-military age, and therefore, for the first time, he was compelled to apply for the temporary exemption of drivers.

The County Appeal Tribunal at Preston, last Friday, heard an appeal by an electrician, but disallowed it, recommending that the appellant should undergo a trade test with a view to his skilled services being used to the full in the Army.

The branch manager of an electrical firm at Lewes (Sussex) has been conditionally exempted on undertaking to join the Volunteer Training Corps.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

60-cycle Transformers on 25-cycle Systems.

In reply to your correspondent Mr. William Lovell, *re* "60-cycle Transformers on 25-cycle Systems," it is very difficult, in the absence of further information, to answer his first query; but assuming the supply voltage is the same in each case, then the flux generated when working on a 25-cycle system will be 2·4 times that on a 60-cycle system, which will mean a magnetising current, probably, considerably in excess of the full-load value, depending upon the degree of saturation. For instance, if ordinary Lohys iron be used in the magnetic circuit, and worked at a maximum density of about 6,000 C.G.S. lines per cm.^{2} for 60-cycle supply, then the maximum density on 25-cycle supply would be 2·4 times; *i.e.*, 14,400 C.G.S. lines per cm.^{2}, which would enable the transformer to supply the load, disregarding regulation. Considering another transformer with the same outward appearance, but whose magnetic circuit is built up of Stalloy iron, worked at a maximum density of, say, 11,000 C.G.S. lines per cm.^{2} for 60-cycle supply, then the maximum density on a 25-cycle circuit will be 26,400 C.G.S. lines per cm.^{2}; the iron being very highly saturated a large magnetising current would be drawn from the mains.

In order to avoid any alteration to the transformers, I would suggest that they be coupled in banks of two in series; the maximum density would then be only 20 per cent. greater than normal, and should allow them to supply a reasonable load.

If the transformers are three-phase, with delta-connected primaries (though hardly likely), they might be coupled star and put across the mains singly; in this case the maximum density would be about 40 per cent. greater than normal.

D. D. Rayner.

Wolverhampton, *June 24th*, 1916.

Throwing-Off Motor-Starting Rheostat from a Distance.

In the interesting first instalment of his articles on "Control Gear for D.C. Motors," in your issue of 23rd inst., Mr. Butler does not mention (in connection with the last diagram) that the short-circuiting tumbler switch should spring back to its normal position when released. This action is very necessary, as otherwise the switch would often be left in the "shorting" position, and the starter would not hold on.

We have no difficulty in modifying our own standard construction to do what is required, and the same can be fitted for either lever or push-button actuation. As regards the bridging of the "way" contacts in passing over, this principle was adopted some time ago in our inductive-circuit switch.

The special motor-stop switch arrangement is all the more necessary when two or more are to be fitted, as the lengths and resistances of the leads tend to increase in such cases. At first sight it may seem impossible to connect more than one of the special stop-switches in circuit, but the problem resolves itself into connecting the top or normal contacts in series, and the "shorting" contacts in parallel. We shall be happy to send a diagram of connections to anyone who is interested.

A. P. Lundberg & Sons.

London, N., *June 26th*, 1916.

The late Prof. Silvanus Thompson.

May I be allowed to add a word to your tribute to Dr. Silvanus Thompson, from the point of view of an old student?

I was at Finsbury 10 years ago, and though I only spoke to him directly perhaps half a dozen times, and have never seen him since, he has always filled a unique place in my mind. "The Doctor" inspired the greatest affection and confidence in all his men, and was at all times ready to give help and advice to those who went to him.

I remember one of his last lectures in my second year, in which he dropped technical matters, as he sometimes did, and was talking of our future lives and prospects; and he told us then that if ever in our future lives we were in any moral or personal difficulty and felt the need of a "father confessor" he was always at our service; and I should never have had the slightest hesitation in going to him with the full assurance of a patient hearing and wise counsel.

Kipling's lines—

"He scarce had need to doff his pride or slough the dross of Earth—
E'en as he trod that day to God so walked he from his birth,
In simpleness and gentleness and honour and clean mirth.
* * * *
Who had done his work and held his peace and had no fear to die."

—might have been written of him, and all those who came under his influence will feel that they have lost a very dear friend, and the world a very perfect gentleman.

S.

Discounts.

Some little time ago you inserted an article on discounts, which showed the waste of time arising from the unnecessary complication of multiple discounts commonly used in the electrical trade. The T.L.A. secretary then pointed out that the T.L.A. issued sheets giving equivalent discounts. To this the writer of the article naturally replied, "Why not use the equivalent right away?"

One notes with delight that this suggestion has been adopted in the new circular sent out, and that one discount is now used to do the trick. What about other branches? The I.R. cable makers might take the hint and do likewise with great advantage.

Hope.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Telegraphic Apparatus.

An interesting application of resonance has been made by Mr. Alban Roberts, a New Zealand inventor, to telephony and telegraphy, and should prove of great utility. In both cases the principle involved is the tuning of a column of air enclosed in a tube after the style of the old "pitch-pipe," in one case to produce any desired pitch at the source of vibrations, and in the other to intensify by cumulative resonance vibrations of a particular frequency, and thus to exercise a selective function.

Taking the familiar reaction between a telephone receiver and transmitter as a basis, Mr. Roberts has devised a buzzer which possesses no make-and-break contacts, and which emits a perfectly clear and sustained musical note for any length of time; as shown

in fig. 1, the watch-type receiver R and transmitter M are coupled in circuit through an induction coil C with a battery B, and are fixed facing each other at a distance apart of a few centimetres, in a cylindrical case which confines the column of air between them, and thus strengthens the reaction. Directly the circuit is closed, a clear, musical note is emitted, in the usual way. The back of the receiver is partly removed to allow of the attachment of a tube T, in which moves a piston P; by varying the distance between the diaphragm of the receiver and the piston, the natural pitch of the enclosed air-column is varied over a range limited only by the length of the tube and the dimensions of the receiver, the natural frequency of the diaphragm of the receiver

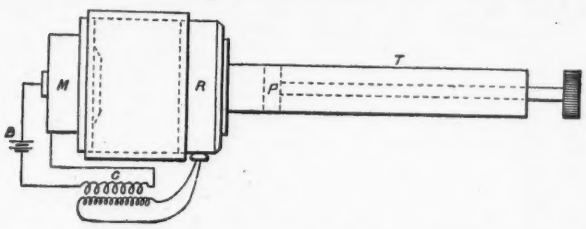

FIG. 1.—DIAGRAM OF THE ROBERTS BUZZER.

being completely suppressed or overcome by that of the pitch-pipe. This arrangement, which Mr. Roberts has demonstrated to us, forms an excellent buzzer with variable note, consuming very little current, and of very simple construction; the signalling circuit can be taken off the secondary terminals of the coil in shunt to the receiver, and the timbre and pitch of the note are admirably adapted for the purpose to which buzzers are applied.

The sound intensifier or amplifier depends upon the same principle, and is purely acoustic in its action. It consists, in one form, of a tube T fitted with a movable piston P, and one or two side tubes *t*, ending in sockets in which telephone receivers R connected with the source of electrical oscillations (such as a wireless antenna) fit closely; to a pocket in the upper end of the tube T is connected a pneumatic head-set such as is used by medical men in connection with the stethoscope, consisting of rubber tubes *r r* which end in ear-pieces *e e*, attached to the steel spring S.

The operator, with the head-set in place, varies the position of the piston in the tube until resonance is obtained with the incoming signals—which is indicated by the manifold increase in the strength of the sounds, as we can testify from experience. Reception can then proceed without further adjustment, but, if desired, a shunt can be applied to the telephone receivers to damp down *all* the oscillations to which they are subjected; obviously those which are not reinforced can be made practically inaudible, while the note which has been selected for intensification remains clear and distinct. The device thus forms a means of tuning out irregular and undesirable oscillations, and retaining only those which are useful; it has the advantage that it can be added

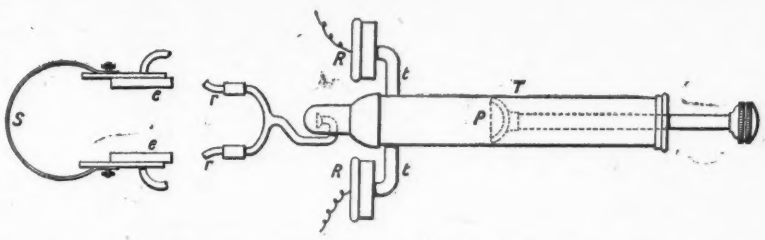

FIG. 2.—DIAGRAM OF THE ROBERTS AMPLIFIER.

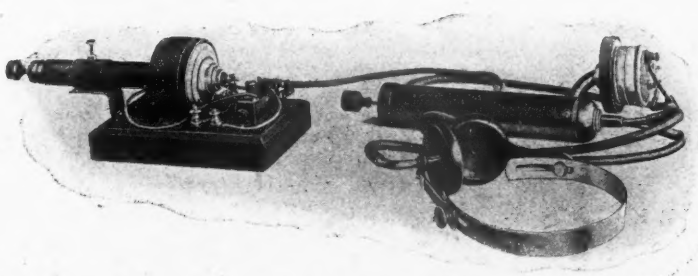

FIG. 3.—BUZZER AND AMPLIFIER IN MODEL FORM.

to any wireless installation without alteration to the latter—instead of listening to the receivers directly, the operator places them in the sockets on the Roberts intensifier, and puts on the head-set of the latter. It is a simple and cheap device, and should find many applications in connections with military signalling, wireless telegraphy, &c. Fig. 3 shows the buzzer connected up to the intensifier—both apparatus in their experimental form, but quite efficient.

We have described the devices in their simplest form; the inventor has devised other forms for applying resonance to both sides of the diaphragm of the receiver, damping down the signals with mechanical means (such as an iris diaphragm, instead of the electrical shunt), providing means to deal with the received signals in the resonating air column electrically, and so on. The practicability of using the same line for a number of different signalling points without confusion is an important feature of the system.

Mr. Roberts may be addressed c/o Messrs. Spencer & Son, 56A, Highbury Grove, London, N.

Electrically-Heated Linotype Metal Pots.

A comparatively new application of electric heating is that of keeping in a molten condition the metal in the pots of linotype machines from which the slugs bearing the characters are cast. The printer finds the electrical method free from the disadvantages of gas and gasoline heating, and the slugs produced are practically perfect owing to the close and accurate regulation of temperature. An electric linotype pot is made by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Each unit consists of a series of resister ribbons of metal alloy encased first in mica, then in metal ducts, and sealed by autogenous welding inside a steel casing. The two main units are immersed directly in the metal in the pot, while two more are disposed about the throat and mouthpiece of the pot to ensure proper temperature at these points. The circuit is initially closed by an ordinary snap switch. Thereafter the circuit is automatically controlled by a special thermometer, set to maintain the temperature desired, which limits the range within 10° either way from the predetermined point. This special thermometer consists of an air-tight metal tube filled with mercury, the enlarged end of which rests in the pot. The other end of the tube is formed into a spiral and attached to a lever. As the temperature rises and falls the mercury in the tube expands and contracts, causing the spiral to open and close and the lever to move back and forth between two contact points. This makes and breaks a relay circuit, in turn controlling the current in the heating elements. In first heating the pot from a cold condition the input is 1,600 watts, and is maintained for about 50 minutes. When the proper temperature point is reached the thermometer cuts it down to the operating rate of 550 watts. As the peak load comes from midnight until morning, the electric linotype pot makes a very attractive addition to central station lines.—*Electrical World*.

LEGAL.

MONOMETER MANUFACTURING CO. *v.* ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD.

MR. MUIR MACKENZIE, one of the High Courts Official Referees, on June 27th, concluded the hearing, at the Royal Courts of Justice, of an action, part heard at Birmingham, in which the Monometer Manufacturing Co. sought to recover from the Electric and Ordnance Accessories Co., Ltd., of Birmingham, the cost of a certain specially constructed and designed installation, consisting of furnaces for melting aluminium and other metals, together with the necessary plant for drawing off and carrying away the metals so melted.

Mr. Colam, K.C., appeared for the plaintiffs, and Mr. Hugo Young, K.C., for the defendants.

By a contract made on January 7th, 1915 between the parties, the plaintiffs agreed to manufacture for the defendants three furnaces for melting aluminium, each with a melting capacity of 1,000 lb., fitted with from 8 to 10 burners each, and with the necessary parts for drawing off the metal into certain smaller furnaces, such parts to consist of a suitable base to bring the outlet pipe over the orifice of the smaller furnaces, which had a melting capacity of 140 lb., so that the metal might be drawn direct from the larger furnaces into the smaller. The plaintiffs agreed to supply these for £230 each, less 2½ per cent. discount, one furnace to be delivered at the Ward End Works within four weeks from the date of the contract. Plaintiffs also agreed to supply 12 furnaces, to be used in conjunction with the three larger ones, each with a melting capacity of 140 lb., without parts for pouring, but each to have three burners with a specially-designed top. These were to be supplied for £52 each, and four of them were to be delivered at the works within four weeks from the date of the contract. Next, there were to be two other furnaces to be used in conjunction with the others, with a capacity of 140 each, to be fitted with pouring spouts and valves, for which the charge was to be £62 each. There were also three furnaces for melting aluminium swarf, each with a capacity of 600 lb., fitted with water-cooled chills, for casting ingots of aluminium, which were to be supplied complete for £248 each. The burners were to consume only about 60 ft. of gas per burner per hour, and it was also agreed that all

the furnaces should be bricked with special silica bricks, to cut down the consumption of gas per burner by about 40 per cent., and to reduce the consumption to a point lower than that of any other system of furnace heating. All the furnaces were to be fitted with special burners, described as Monometer low-pressure gas burners, Monometer patented gas chamber, and all the latest improvements.

The DEFENDANTS said that the furnaces were not according to contract, and would not satisfactorily do the work for which they were required, and they counterclaimed for damages and for the return of money paid. They said that the plaintiffs contracted that the furnaces should be reasonably fit for melting aluminium to be cast in chilled moulds for fuses, for producing a molten product of pure aluminium absolutely free from particles of iron or other foreign matter, and free from porosity and other flaws and defects, and that the pots forming parts of the plant should not produce scale, but should produce castings suitable for pressing and machining all over. Another condition was that the specified number of burners would produce such a temperature as would be required satisfactorily to melt aluminium for the production of castings. These conditions the defendants said were not complied with by the furnaces supplied. The defendants stated that they required the furnaces and plant for the purpose of melting aluminium for castings in chilled moulds for the purpose of manufacturing fuses, for which manufacture they had prepared plans of a proposed new foundry for an estimated output of between 50 and 60 tons of castings per week. The defendants further alleged that the delivery was not made to time, and that when delivered the furnaces did not work satisfactorily, and that they were not reasonably suitable for the work.

The plaintiffs' case was completed at the hearing at Birmingham, where the evidence of Prof. Arnold and other expert witnesses was taken, in support of the plaintiffs' contention that the furnaces were capable of carrying out the work for which they were intended.

Further evidence was called for the defence at the resumed hearing in London to prove that the specified number of burners did not produce such a temperature as was required sufficiently to melt the aluminium for the castings, and that the necessary degree of liquidity could not be produced with the consumption of gas indicated, and that in fact a much larger consumption of gas was used in attempting to obtain the liquidity. It was said that although attempts were made to make the furnaces comply with the contract conditions they had not been successful.

MR. WILMOT, the works manager for the defendants, was recalled, and further cross-examined by Mr. Colam, when he said that the scum in the ladling pots was sometimes half an inch in thickness. The cold metal was put in at the top as the molten metal was drawn off at the bottom, and in this way the accumulation of scum might have been assisted. He had all through complained of the excessive oxidation. The Monometer furnaces had been offered as being capable of minimising the oxidation, but practice had proved, in his opinion, that they did not. His view was that the principal cause of oxidation was the long time it took to melt the metal. The quicker the melting the less the oxidation. The average heating power was not sufficient, and consequently they could not get their output. When he complained the plaintiffs expressed their astonishment and made certain alterations, but they did it on their own responsibility, and not in consequence of any request from him. In making the contract, he wanted to get furnaces without compressed air or other forced draught and the plaintiffs represented that their furnaces met this requirement.

In re-examination, the WITNESS said that to supply the shops he had to have a certain output from the foundry, and he wanted the quickest and best way of getting the metal down, but the plaintiffs' furnaces took a much longer time to get it down than had been represented, and that necessarily affected the output.

MR. NUTHALL, head foreman at the defendants' works, also gave evidence as to alleged shortcomings of the Monometer furnaces.

MR. THOS. TURNER, Professor of Metallurgy at Birmingham University, who said he had been interested for more than 30 years in the production of aluminium and was acquainted with the practice in the chief Birmingham aluminium foundries, gave evidence as to what was meant in the trade by the term "aluminium" and aluminium castings. The term to a chemist would mean pure metal, but in the trade it meant an aluminium alloy consisting of a percentage of zinc or copper. The melting of ordinary aluminium in an iron pot would have very little effect upon the pot, but in the case of an alloy of zinc the iron pot would be affected by the zinc, which would make a distinct crystallised compound. The zinc would take up the iron which was attacked very shortly after the melting point of the zinc was reached, and for practical purposes the iron pot ceased to be an iron pot. He attributed the accumulation of scum to excessive heat or to a longer time being taken in the melting. If the metal was a long time melting, there would be oxidation. The scum on the top of the ladling pot would affect the molten metal underneath, because there would be a certain amount of oxidation distributed below any large amount of scum, and the effect upon the castings would be that they would be less sound and harder to machine.

In cross-examination, the Witness said that if he ordered aluminium articles, he would expect to get an alloy; but if he ordered aluminium from a metal merchant, he would expect to get aluminium of 99 per cent. pure. Sometimes a little magnesium was present in aluminium castings, and sometimes he found a little iron. Pure aluminium would not attack the pots, but when there was a mixture of zinc with it, the zinc would do so. Zinc always attacked iron, and would do so even though there was aluminium with it. It was a common thing to coat iron pots, but he objected to say what the coating was, as it was a secret process.

Pressed to say what the process was, Witness said that it was a French secret brought over by a Frenchman. It was in the form of a wash, and had to be renewed from time to time. It was largely composed of chalk or whiting, and was mixed with something which made it stick.

Other witnesses said that in consequence of the Monometer plant failing to do its work properly, there was delay in the defendants' output, and they had to place some of their work in other hands. One witness (Mr. Monroe, their accountant) said that up to the end of July the furnaces produced 1,300,000 castings, which represented about 20 tons a week, instead of 50 tons required. There was necessity for an even larger output than 50 tons required. Up to the end of July there was no intention to get rid of the Monometer furnaces; on the contrary, they were endeavouring to get the Monometer people to work them.

After further evidence had been given for the defence, the Official Referee reserved judgment.

D. DAVIS & SONS, LTD., *v.* THE ASSESSMENT COMMITTEE OF PONTYPRIDD UNION, OVERSEERS OF RHONDDA AND THE RHONDDA URBAN DISTRICT COUNCIL.

THIS case came before the Court of Appeal, composed of Lords Justices Swinfen Eady, Phillimore and Bankes, on June 21st, upon the appeal of the respondent Assessment Committee, Overseers and Urban District Council, from a judgment of a Divisional Court, consisting of Justices Ridley, Lush and Low.

The short facts appeared to be these:—

D. Davis & Sons, Ltd., are the owners and occupiers of certain mines and their appurtenances, and in 1904 they made with the Assessment Committee an agreement by which, for the purposes of rates, the assessment of the property was to be calculated on the output of coal, the agreement being determinable by one year's notice. Some small electric stations were attached to the appellants' pits, and for some years they purchased a large amount of power from an electric power company, but in 1907 they erected an electric power station of their own, and from that time the small stations went out of use, and the company reduced the amount of power that they purchased. Down to April, 1913, the assessments on the company's property were made in accordance with the agreement, the electric power station not being assessed separately from the rest of the colliery. In April, 1913, the Assessment Committee, having given previous notice determining the agreement, assessed the electric power station separately from the rest of the colliery; but they still assessed the latter in accordance with the agreement. The Divisional Court held upon the question of the company's appeal against the poor rate that although the Assessment Committee of 1904 had no power to bind subsequent Assessment Committees, yet as the Assessment Committee of 1913 could not repudiate the agreement so far as concerned the power station, since they had affirmed it as regarded the rest of the company's property, there was no power to rate the power station separately as long as the rest of the property was rated in accordance with the agreement. The Court, therefore, held that the rate was bad and remitted the matter back to Quarter Sessions, with an intimation to that effect. Hence the present appeal.

At the conclusion of the arguments of Counsel, their Lordships affirmed the decision of the Divisional Court, and dismissed the appeal with costs.

POWER *v.* PRINCE OF WALES DRY DOCK CO.

AN unusual claim under the Employers' Liability Act, for personal injuries, came before his Honour Judge Bryn Roberts, at the Swansea County Court, the other day, when Wm. Power, boilermaker, of Cardiff, sued the defendant company, of Swansea, for £47 odd for damages sustained through the alleged negligence of the defendants, by which he received a severe electric shock that rendered him incapable of work for over a fortnight. The plaintiff was in the employ of the Oxy-Acetylene Welding Co., who were sub-contractors to the Dry Dock Co. in carrying out certain work on the steamship *Lille* at Swansea, in March last. Plaintiff was engaged in trundling some gas cylinders from the stokehole into the engine room, and at the same time some of the defendants' men were engaged with an electric drill, for which purpose an electric cable was conveyed from the quayside to the engine room. The cable trailed along the floor of the engine room, and as the plaintiff brought in the third gas cylinder he received an electric shock that rendered him insensible for some time. It was afterwards discovered that the insulation of one of the electric wires had been cut in several places, presumably by the collar of the cylinder, and it was supposed that by this means the current escaped along the iron floor of the engine room. For the defence it was urged that there was no negligence, and that if there were any, it could easily have been obviated.

MR. DAVID FULTON, the chief electrician to the Swansea Harbour Trust, who supplied the current, and other witnesses, deposed that they had experimented with a cable under the same conditions, and not more than 175 volts was possible to go through the body. They suffered no ill-effects whatever from the shock. Mr. Fulton added that the biggest shock he ever sustained in his life was of 1,500 volts; but he admitted that less than 100 volts had been known to kill. The latter, however, was alternating current.

HIS HONOUR said there was negligence in allowing the cable to trail along the floor when it might easily have been hung up out of danger, and he awarded the plaintiff £23 and costs.

STEALING ELECTRICITY.

A FINE of 40s. was imposed at Llanhilleth upon Esau Protheroe, a local collier, for fraudulently consuming electricity, the property of the Abertillery U.D.C., between March and April. Defendant pleaded guilty. Mr. A. H. Dolman, Abertillery, diverted the current from the meter by means of a pin, and conveyed it direct to the lamp.—*South Wales Daily News.*

BUSINESS NOTES.

South African Electrical Requirements.—The *South African Mining Journal* for May 27th says:—"All the municipalities are quietly in the market for switches, copper, and everything connected with electrical power driving machinery. As regards household goods, under this heading, the recent frosts have created a brisk demand for radiators, and in this respect it is pleasing to record that the complete framework of these have been made in Johannesburg for several seasons past, and those now presented are an improvement over last season's. A large dealer thinks that the local makers will oust the imported article, as any metal worker can make them in his spare time, &c. However, they are about 15 per cent. dearer than the imported goods. It must not be omitted to mention that the higher voltage lamps are getting scarce, as it is very difficult to obtain 2,000 candle-powers for the mines, and not easy to get the 1,000 kind."

Wolverhampton Electrical Trade.—In the annual report of the Wolverhampton Chamber of Commerce, the following reference is made to the electrical engineering trade:—"Throughout the year the demand made by the Allied Governments for electrical plant of all descriptions has been exceedingly heavy, many innovations having been introduced for special electrical requirements. Local factories have been, and are still, working day and night to meet the requirements. There is a distinct indication of an increase of trade with the Colonies, due to the supplies from enemy countries having been cut off."

Nottingham as an Industrial Centre.—A well-organised effort is being made to popularise the advantages possessed by Nottingham as a centre for new manufacturing industries. A glance at the map shows the ample nature of the railway connections between the city and the great seaports, also the excellence of the waterway connections. Powers have been secured by the Corporation under which they will spend £160,000 for increasing navigational facilities, but, unfortunately, this work is inevitably held up until a year after the war. At a time when new industries are being established, or when existing companies and firms are contemplating the building of new works, the claims of the district, with its ample fuel supplies, the cheapness of raw materials, &c., are well worthy of consideration. A Special Committee has been appointed to undertake the commercial development of the city, and an Industrial Development Officer has been appointed to devote his whole time and energies to the department. Communications may be addressed to him at the Guildhall, Nottingham.

New T.L.A. Lamp Discount Scheme. — MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of 38 and 39, Upper Thames Street, E.C., have sent us two booklets explaining the new lamp discount scheme that has just been inaugurated. One of the booklets deals with the scheme from the point of view of the trade reseller, and the other from the point of view of the trade user. They have already been distributed to a number of their customers, and copies will be supplied to any of our readers who are interested in the purchase of Wotan or other makes of T.L.A. lamps. In order that the scheme may be thoroughly and generally understood, we may say that it is based on the quantity of lamps purchased and delivered during 12 months, and the discounts are regulated in accordance with certain stipulated minimum quantities or equivalent net money values. The money values are introduced to cover half-watt type lamps, which, of course, are higher in initial cost. The total annual turnover in all makes of Association lamps will, therefore, regulate the terms at which Wotan, half-watt type, or tantalum lamps can be supplied. The booklets give an example of the method of procedure. A new customer will commence to buy lamps at 20 per cent., but immediately his total purchases of T.L.A. lamps amount to 500 he will automatically become entitled to buy at 22 per cent. In order to avail himself of these terms he must notify the secretary of the T.L.A., and, in addition, he will receive from his supplier, or suppliers, a credit note for the difference between 20 per cent. and 22 per cent. on the original lamps purchased. As each succeeding step is reached the increased discount will be obtained by means of the same procedure. There are, of course, a number of customers who were graded at a definite figure under the previous arrangement, and they will now receive the terms specified for a quantity of lamps based on their past purchases. This will bring them into the new scheme at, approximately, the discount to which they are entitled in accordance with their established turnover, and increased discount will be allowed should they improve on their previous figures. The terms for the trade user have been somewhat revised, and if lamps are purchased in quantities of less than 50, a discount of 15 per cent. only is allowed. Providing the lamps are ordered in quantities of 50 and over for delivery at one time, the standard schedule of discounts are applicable. It is therefore claimed that the scheme is absolutely equitable, and ensures to each trade buyer a discount directly in proportion to his turnover. As the discounts increase in a succession of easy steps the scheme should be an incentive to business extension. All invoices will be subject to one discount (*i.e.*, the one corresponding to the minimum quantity taken), plus the usual 2½ per cent. (cash) approved monthly account. This obviates the multiplicity of discounts, which are sometimes confusing, and often cause inconvenience and misunderstanding.

Australian Insulators.—According to the *Melbourne Age*, the assurance was given by the Postmaster-General to Mr. Fenton (V.), in the House of Representatives, on May 11th, that the Postal Department was encouraging the manufacture of insulators in Australia, with a view to becoming independent of importations. The following comparative statement shows the extent of the Australian orders, as against importations:—

Year.	Australian.	Imported.
1911	£800	£12,747
1912	421	11,190
1913	329	17,115
1914	4,490	14,444
1915	9,359	5,063

Bankruptcy Proceedings.—THE COLSTON ELECTRICAL WORKS, LTD., 9, Denmark Street, Bristol.—The winding-up order in this matter was made on the petition of a creditor. The liabilities amount to £1,573, to meet which there are net assets of £991, the estate disclosing a deficiency of £582 as regards unsecured creditors, whilst as regards contributories there is a deficiency of £2,234. The company was registered in December, 1913, with a nominal capital of £3,500, to acquire, as a going concern, the business of electrical engineers promoted by G. J. T. J. Parfitt and W. J. Webber, trading as Parfitt, Webber & Co., at 9 and 10, Denmark Street, Bristol. By an agreement of January, 1914, the vendors agreed to sell to the company the goodwill, plant, machinery, stock-in-trade, implements, utensils, book debts, and contracts, &c., which the vendors were entitled to in connection with the business, for 1,600 fully paid-up shares, the company to discharge all the trade liabilities of the said business, and the liability of the vendors' firm to the Capital and Counties Bank, Ltd. The business was taken over from July, 1913, and from that date down to January, 1914, the date fixed for completion, the vendors were deemed to have been carrying on the business on behalf of the company. The directors appointed were Miss H. L. W. Parfitt, Bath; A. E Finch, Weston-super-Mare, electrical engineer; and E. W. Brock, Keynsham, glass tile manufacturer. At a meeting of directors, A. E. Finch was appointed chairman. An agreement was entered into in January, 1914, whereby A. E. Finch was to act as manager at a weekly salary of £3, and on the same day E. W. Brock was appointed secretary. The company was registered as a private company, and no capital was offered to the public for subscription, and no prospectus was issued. A meeting of the six largest creditors was convened by E. W. Brock in May, and an offer was made of a composition of 12s. 6d. in the £, payable as to 2s. 6d. forthwith, 5s. in one month, 2s. 6d. in two months, and 2s. 6d. in three months. Mr. Brock also issued a notice, signed by him as secretary, without consulting the other directors, convening an extraordinary general meeting of the company for the purpose of submitting an extraordinary resolution for voluntary liquidation and the appointment of a liquidator. Three shareholders apparently attended this meeting, the resolution was passed, and on May 30th, notwithstanding that the hearing of the petition for a winding-up order was to be heard by the Court on the following day, the liquidator purported to have been appointed sent out a notice convening a meeting of the creditors of the company to be held for the purpose of confirming his appointment as liquidator. In these circumstances the meeting was abortive. The failure was said to be due to loss of £725 through bad debts in 1914, and want of capital. From its inception the company has never had sufficient capital, and in 1914 it lost £650 through the failure of the Bristol International Exhibition, Ltd., and £75 through the failure of G. J. T. J. Parfitt in February, 1915. The usual books of account have been kept, but the cash book has not been balanced, and the books in general have not been properly posted. The following are creditors:—

British Ever-Ready Co. ...	£194	Hodge, Jacques & Co.	£11
Bristol Corporation Electricity Department	14	Joyner, C., & Co.	10
Callender's Cable & Construction Co.	43	National Telephone Service ..	14
Cryselco, Ltd.	98	Metallic Seamless Tube Co. ..	22
Drake & Gorham, Ltd.	15	Premier Accumulator Co. ..	20
Edison & Swan United Electric Light Co.	133	Willey & Co.	20
Haslam & Stretton, Ltd. ..	77	Wilesmith, John, & Co. ..	12
		Wright, Harland	17
		Parfitt, Webber & Co.	731

R. E. CONNOLD, late electrician, now R.N.A.S., late 6A, The Parade, Canterbury.—The public examination of this debtor was fixed for June 17th, at Canterbury. Debtor was unable to obtain leave to attend the Court. The case was, therefore, adjourned.

South American Trade.—The Hon. R. C. Parsons, chairman of the King's College Delegacy, presided at a lecture given by Colonel Don Pedro Suarez, Consul-General for Bolivia, at King's College last week, on the subject of "Bolivia, its Geography and Industries," and said that the greatest bar to British trade in South America was the refusal of the British merchants to adopt the metric system, and their unwillingness to make goods to suit other peoples' necessities. This refusal had sent great quantities of trade into German hands.—*Morning Post.*

Dissolutions and Liquidations.—READER'S PATENTS AND ENGINEERING CO., LTD.—A meeting is called for July 26th, at 3, Portland Street, Southampton, to hear an account of the winding up from the liquidator, Mr. E. W. C. Whittaker.

STANDARD CABLE MANUFACTURING CO., LTD.—Creditors should send particulars of debts, &c., to the controller, Mr. J. S. Feather, 35, Great Tower Street, E.C., by July 31st.

SHIP CARBONS, LTD.—Creditors should send particulars of debts, &c., to the controller, Mr. W. Hancock, 90, Queen Street, E.C., by August 7th.

BLEICHERT'S AERIAL TRANSPORTERS, LTD.—Creditors should send particulars of their debts, &c., to the controller, Mr. W. Hancock, 90, Queen Street, E.C., by August 7th.

ECONOMISERS, LTD.—A meeting is called for July 28th, at 18, Theobald's Road, to hear an account of the winding up from the liquidator, Mr. W. F. Johnson.

HOBART ELECTRIC TRAMWAY CO., LTD.—A meeting is called for August 3rd, at 5, Bucklersbury, E.C., to hear an account of the winding up from the liquidator, Mr. F. J. Warner.

JOHN ROBERTS & SON, boiler coverers, Salt Street, Manningham, Bradford.—Messrs. J. W. Roberts and S. Haigh have dissolved partnership. Mr. Roberts will attend to debts, and carry on the business at 29, Princes Crescent, Bare, Morecambe, under the same style.

Book Notices.—"Trade as a Science." By Ernest J. P. Benn. London: Jarrold & Sons. Price 2s. 6d. net.

"Large Electric Power Stations." By G. Klingenberg. London: Crosby Lockwood & Co. Price 25s. net.

"Electrical Engineering." By E. J. Berg and W. L. Upson. London: Hill Publishing Co. Price 17s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXV. No. 6. June, 1916. New York: The Institute.

"Science Abstracts," A and B. Vol. XIX. No. 222. June 26th, 1916. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

"Scientific Paper of the Bureau of Standards," No. 276, "Protected Thermo Elements." Washington: Government Printing Office.

The *Magazine* of the Finsbury Technical College and Old Students' Association for May contains a portrait and obituary notice of the late Prof. R. Meldola, F.R.S., the continuation of a paper on "Humphrey Pumps," by J. G. Bulger, and a further Roll of Honour of remarkable length.

Board of Trade Inquiry.—The Commercial Intelligence Branch of the Board of Trade has the name and address of a firm of agents and importers of electrical material at Brescia, Italy, which wishes to secure the agencies of United Kingdom manufacturers of electrical plant and machinery, measuring instruments and gauges, apparatus and material for electrical plant, and porcelain and insulating material in general. Reference No. 202.

The Commercial Intelligence Branch of the Board of Trade has received inquiries from Home firms for makers or producers of manganese dioxide for Leclanché batteries, and electrical novelties.

Catalogues and Lists.—THE BONECOURT WASTE HEAT BOILER CO., LTD., Parliament Mansions, Victoria Street, S.W.—New catalogue dealing with gas-fired boilers and waste-heat boilers, describing the Bonecourt surface-combustion system; in view of the increasing importance of economising fuel and recovering the by-products from coal, the contents of this brochure are exceptionally interesting. Tables are given showing the standard sizes of the boilers, the performance of each tube with different kinds of gas, and the draught required, with illustrations of the details of the plant and the lay-out recommended. The results of a test by an independent expert are included, showing the efficiency of an unlagged Bonecourt boiler and feed-water heater to be 92·7 per cent. It is claimed that an evaporation up to 20 lb. of steam per sq. ft. of heating surface per hour is obtainable, and that 48,000 lb. of steam per hour can be generated on a floor space of 225 sq. ft. A battery of boilers for 12,000 H.P. occupies a space of only 48 ft. by 33 ft., and a CO_2 content of 18·1 per cent. in the flue gases is recorded. The boiler can be utilised for recovering heat from the exhaust gases of gas engines, coke ovens, steel furnaces, &c. A new method of mixing the air and gas has prevented back-firing, and the refractory material is now made on a greatly improved system, so that over 3,000 cb. ft. of producer gas can be burnt per hour in one tube 6 in. in diameter and 15 ft. long.

MESSRS. MOSSAY & CO., LTD., 41, Tothill Street, Westminster, S.W.—Illustrated pamphlet (20 pages), describing the "Orwell" electric vehicle of 1½, 2½ and 3½-ton sizes. A number of improvements and additions to the equipment of the vehicles are included.

THE BRITISH THOMSON-HOUSTON CO., LTD, Rugby.—Price list No. 4,310, describing and illustrating their type EK, form B, iron-clad switch fuses.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Twenty-page illustrated pamphlet (No. 21 C), in their standard form and size, containing full illustrated specification, detailed tabulated data, output ratings, weights and dimensions, of the Peebles self-contained continuous-current dynamos and motors. Sixteen frame sizes, which are listed, can be manufactured in any of the usual types.

EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—Two illustrated and priced leaflets of Ediswan electric fans of various types. The company has also issued a very handy pocket book in a distinctive red cover, containing "Ediswan discount tables" from ⅛ to 50 per cent. The book is issued for the convenience of the members of the trade, and it contains various tables not to be found in the ordinary discount books, but useful in making up discount on T.L.A. lamp prices, such as 22 per cent., 24 per cent., 27 per cent., 28 per cent., 32 per cent., 34 per cent., 36 per cent., 39 per cent., &c.

MESSRS. BELLING & CO., Derby Road, Edmonton, London, N.—Two-fold circular, containing description of their electric immersion heaters, with diagrams showing the methods of their application, also giving dimensions and prices.

Trade Announcements.—MESSRS. MARBRO, LTD., have removed to larger premises at Palace Wharf, Rainville Road, Fulham, S.W. Telephone No.: "Hammersmith 1215."

The electrical and engineering advertising business of Mr. A. J. GREENLY will in future be conducted as A. J. Greenly & Co., and will have additional offices at 37 and 38, Strand, W.C.

THE GENERAL ELECTRIC CO., LTD., announce that the address of their Cork branch, from whence all orders from the South of Ireland are attended to, has now been altered to 76, Grand Parade.

For Sale.—MESSRS. PERCY HUDDLESTON & CO. will sell by auction, on July 11th, at Dalling Road, Hammersmith, a quantity of electrical apparatus, &c. Full particulars are given in our advertising pages to-day.

Copper Prices.—THE WEEK'S CHANGES.—F. SMITH AND CO. report, Wednesday, June 28th:—Electrolytic bars drop from £139 to £130; ditto sheets, £157 to £150; ditto rods, £146 to £137; ditto H.C. wire, 1s. 5½d. to 1s. 4⅝d.

JAMES & SHAKESPEARE report, Wednesday, June 28th:—Copper bars, sheet and rod (best selected), drop from £160 to £152.

LIGHTING AND POWER NOTES.

Aberdeen.—ENGINEER'S REPORT.—Mr. Bell, the Corporation electrical engineer, in a report regarding new generating plant, says:—"The Council's decision not to proceed with the additional installation suggested in November last precludes the installing of plant for the winter of 1916, and the question now to be considered is the provision of new generating plant before the winter of 1917. The output for the 10 months ending May 31st is 2,030,360 units above the previous corresponding period, being an increase of 19·1 per cent. The remaining two months will, at a conservative estimate, add a further half million units increase, which would make a 23 per cent. increase for the year—a figure only once exceeded in the history of the undertaking. Additional motors of 2,027 H.P. have been coupled up since July 31st last, and applications for a further 1,291 H.P. have been received. No. 1 turbine has now generated 28½ million units, being 19 millions in 22 months and 9½ millions in the last seven months. A further 500-KW. converter has been ordered since the last report, and, therefore, the 1,000-KW. set recommended in November last can meantime stand over. A 5,000-KW. turbine alternator, if ordered now, can be delivered for next summer, and will, I estimate, cost £18,000."

Australia.—POWER STATION PLANT.—For the power station plant and equipment for the Commonwealth naval dockyard at Cockatoo Island, one tender only for engines of Australian manufacture was submitted—viz., for reciprocating engines; the tenders had been originally invited under the heading of four alternative schemes—viz., geared turbo-generators, reciprocating sets with exhaust turbines, reciprocating sets and exhaust geared turbo-generators, and Diesel engine sets. Acting on the advice of the British Admiralty, who endorsed the recommendation of local experts, the Naval Board has adopted the first alternative scheme, and orders have been placed for Parsons-Crompton geared turbo-generator sets. It is stated that for reciprocating engines the price quoted by the Australian manufacturers and that submitted from abroad showed a difference of something like 70 per cent.—*Sydney Morning Herald.*

Barnsley.—PRICE INCREASE.—Having considered the report of the borough electrical engineer on the working of the department for the past year, and in view of the loss thereon, the Electricity and Lighting Committee has decided that the price of energy be increased by ½d. per unit for lighting, and 10 per cent. for power consumers.

Beckenham.—PRICE INCREASE.—The D.C. has decided that the charge for electricity for lighting shall be raised to 7d. per unit, to take effect from Saturday last.

Bedford.—The R.D.C. has given consent for the T.C. to supply current to the new works of Messrs. W. H. Allen, Son and Co., to be erected in the rural district.

Bolton.—Despite the Summer Time Act, the electrical engineer reports no appreciable decrease in the consumption of electricity. Lighting restrictions had already considerably reduced the quantity used for lighting purposes.

Colwyn Bay.—PRICE INCREASE.—Owing to the heavy increase in the price of fuel, the U.D.C. has decided, from the close of the present quarter, to advance the price of energy from 5d. to 5½d. per unit.

Coventry.—PRICE INCREASE.—The Electric Light Committee recommends an increase of the scale of charges for the supply of energy for power proportionately to the increased cost of coal.

Darwen.—Fire broke out, on Monday, at the Darwen electricity works, and the man in charge of the engine room, Joseph Munroe, was burned about the face in a plucky attempt to stop an engine. The fire brigade extinguished the flames.

Dundee.—Year's Working.—The total units sold last year amounted to almost 18½ millions, an increase over the previous year of 3½ millions; the net income, which showed an increase of fully £12,700, was £78,295. The costs also showed a large increase, being £10,000 in excess of the previous year. The coal account itself practically represented the entire increase, this item being £9,800 more than in the previous year. The accounts closed with a net profit of £409.

Gosport.—Restriction of Output.—The Gosport and Alverstoke Electric Supply Corporation has notified its consumers that owing to the difficulties in obtaining skilled labour, it is feared that it may be necessary in the near future to restrict, if not entirely cancel, the supply of electricity for power, heating, and lighting, and also for the service of the tramways.—*Portsmouth News.*

Heston and Isleworth.—Year's Working.—The engineer reports that, as the result of the "Summer Time" Act, the output has fallen 200 units per day. He estimates the approximate loss during the summer at £400 to £450. The Electricity Committee reports that there was a deficit on last year's working, after taking into account expenditure on new plant and the previous year's deficit of £1,049, which arose mainly from the high price of coal. Each unit sold cost for coal '55d. against '38d. in the previous year. The total number of units sold was 1,288,371 against 1,162,995 in the previous year, and the increase of expenditure—due entirely to the rise in the price of coal—after allowing for the reduction in consumption per unit due to the larger amount generated, was well over £900. The prices of coal showed an increase on last year, and the Committee had no other course open to it but to raise the charges by 12½ per cent. In his annual report, the engineer, Mr. P. E. Rycroft, states that the income was £11,246, an increase of £751, and the working expenses £7,031, giving a profit of £4,214; but interest and loan charges were £4,927, which caused a deficit of £712. The main cause of the deficit was the cost of coal, which was £1,088 in excess of the previous year. The total units generated were 1,564,473, an increase of 55,246, but the units sold increased by 125,376. The works costs had risen from 1·03d. to 1·23d. per unit, and new business had been very difficult to obtain.

Hornsey.—Year's Working.—There is a deficit of £2,789 on the net revenue account of the electricity undertaking for the year ended March 31st last. The total expenditure for the 12 months, including the purchase of meters, amounted to £11,035, an increase of £470 compared with a year ago. On the other hand, the total receipts showed a falling-off of £1,720, the respective figures being £20,570 and £22,290. The balance, transferred to net revenue account, shows a reduction on the previous 12 months of £2,189. The balance to the credit of this account is now £3,984. The Council has again found it necessary to increase the prices for energy and meter rent, this time by a further 15 per cent., provided they do not exceed the authorised maximum rates.

Hull.—Year's Working.—The annual report to the T.C. on the working of the electricity undertaking states that the revenue from all sources amounted to £89,208, and the total working expenses, exclusive of special charges, to £47,178, leaving a balance of £42,030. Of this amount, interest and sinking fund absorbed £33,950, income-tax £2,106, and special charges £1,727, leaving a net balance to be carried to the reserve fund of £4,247. The revenue from lighting showed a decrease of £5,000 on the figures for the year 1914-15. On the other hand, the increase in revenue from power amounted to £9,517, approximately 22 per cent. over last year's figures. The units sold for all purposes increased from 12,969,776 to 14,795,426, being an addition of 14 per cent., and the additional income under this head was £4,207. The revenue from power supplies more than compensated for the decrease on the lighting side. The works costs and total cost were the lowest recorded by the undertaking. The total connections to the mains were:—Power, 20,470 KW.; and lighting, 8,320 KW. The city accountant stated that the income for the year increased by £6,908 on the previous year's working. During the year capital outlay amounting to £2,476 was met out of revenue, and £6,760 out of loans. The total capital expenditure on the undertaking was £540,099.

The town clerk has been instructed to take the preliminary steps towards getting an order to authorise the Corporation to supply electricity to the new sanatorium at Cottingham.

India.—Electric Lighting.—It is stated that the Mukhis and the leading Sind merchants of Hyderabad are forming a company on the lines of the Karachi Electric Corporation to supply electricity to the town of Hyderabad. The preliminary details have been settled. The firm of Messrs. Mukhi Hiranand Tarachand are to be managing agents for the company. The engineers of Messrs. Tata & Sons' electric works near Bombay are to be consulted. It is proposed to utilise the River Indus for the supply of power.—*Indian Engineering.*

Kingstown.—The U.D.C. has made an arrangement with the Munster and Leinster Bank for a loan of £6,000 at 4½ per cent., for three years, to cover the preliminary expenses in connection with the electric lighting scheme.—*Irish Builder.*

London.—Hampstead.—Price Increase.—The B.C. has decided, owing to the cost of coal, to increase the charges for electricity by 23½ per cent. from January 1st, making, with the 10 per cent. then made, a total advance of 33½ per cent. on the pre-war charges.

St. Pancras.—Price Increase, &c.—The Electricity Committee has had under consideration the question of revising the charges for energy, in view of the serious financial loss falling upon the undertaking, and having due regard to the continuance of the 10 per cent. at present added to all accounts, recommends the following increased charges, which are estimated to produce an additional income of £18,000 during the year:—(1) Present charge of 1d. per unit for power, heating and cooking to be increased to 1½d.; (2) present rebate of 20 per cent. allowed for "factory" lighting (exclusive of offices, showrooms, &c.) to be abolished, and a flat rate of 3d. per unit charged in lieu thereof; (3) present two-rate system of 6d. per unit between the hours of 4.30 p.m. and 8.30 p.m., and 1d. per unit afterwards, to be abolished; (4) present maximum-demand tariff of 6d. and 1½d. per unit to be increased to 6d. and 2d., and the introduction of a flat rate of 3d. per unit for kinema theatre supplies; (5) KW. demand system of charging of £4 per annum, plus ½d. per unit, to be abolished; (6) meter rents to be charged on a sliding scale in regard to all supplies, instead of only, as at present, where a factory lighting rebate is allowed, and for cooking and heating purposes, &c., and where the maximum-demand indicator is used. The Finance Committee is in full agreement with the above proposals, and in view of the fact that, as a result of the agreement come to with the L.C.C. to accelerate the periods of repayment of loans, an additional sum of £1,454 a year will have to be paid from revenue during the next three years, has recommended that the interest of about £1,500 a year earned by the reserve fund account should be taken into revenue, instead of accruing to the reserve fund as heretofore. Arrangements have been made for laying an E.H.T. main in Gray's Inn Road to supply current for power purposes; this work will necessitate the re-arrangement of the switchboard at the Tavistock Place sub-station, at a cost of about £462. The Committee has received a reply from the Board of Trade in reference to representations made as to the necessity of an adequate supply of coal for the undertaking, suggesting that in any case in which the Council is unable to renew a contract, it should communicate with the Coal Supply Committee for the district in which the colliery concerned is situated, and that immediate steps be taken to renew contracts which will shortly expire. The Committee has also received a reply from the Admiralty Coasting Trade Office, stating that every effort will be made to assist the Council to secure supplies.

Poplar.—Year's Working.—The annual report of the electrical engineer and manager, Mr. J. H. Bowden, shows that the energy sold amounted to 21½ million units, an increase of 4½ millions, or 27½ per cent.; the net income from the sale of energy was £88,490, an increase of 20¼ per cent.; and the working expenditure was £52,179, an increase of 45 per cent. The gross profit was £36,311, a slight decrease on the previous year; and after deducting interest £11,530, repayment of loans £12,860, and sundry charges £563, there remained a surplus of £11,814, a decrease of 20 per cent. With the unappropriated balance of £10,220 from last year, there was a total surplus of £22,035; a sum of £3,500 was transferred to the rates, about £8,000 was applied to sundry items of capital expenditure, alterations, &c., £1,000 to the staff as a bonus, and £617 was transferred to the superannuation and pensions fund, leaving an unappropriated balance amounting, with other items, to £11,667. The Council has decided that after providing a working balance of 10 per cent. of the total income, 40 per cent. of any available surplus shall be carried to the general fund for relief of rates; 20 per cent. up to an amount of £6,000, and 10 per cent. above that figure, as bonus to the staff; and the balance to meet capital expenditure. The agreement between Poplar and Stepney enables an output of 25 million units per annum to be attained before extensions at Poplar are necessary. The average price of coal rose from 12s. 5½d. per ton in the previous record year to 17s. 11½d. last year; but the working costs have only risen from 0·51d. to 0·58d. per unit, which is claimed as the record for the metropolitan area for the past year. The average price of 0·988d. per unit is also stated to be a record; deducting the supply to Stepney, the price for the Poplar area becomes 1·087d., which is claimed as a record to date. The capital employed per KW. of plant installed (£30·7) is believed to be the lowest in the country, and the output is said to be the largest yet published in connection with any metropolitan municipal undertaking. The load factor was 30·2 per cent., compared with 28·8 per cent. in the previous year. The sale of energy for private lighting was 1,125,005 units; for domestic supply (fixed charge + ½d. per unit), 935,414; for power, 16,647,703; for bulk supply, 2,556,946; and for public lighting, 241,546 units. The accounts are published in a remarkably complete and detailed form.

St. Marylebone.—A.C. Plant.—In recommending payment of the final instalment on the extra-high-pressure three-phase generating plant installed on the recommendation of the general manager, Mr. A. H. Seabrook, the Committee reported on the results of the whole scheme. During the year ended March 31st, 1914, 24 per cent. of the total energy generated at the station was supplied from this plant; to March 31st, 1915, it generated 94 per cent., and for the year ended March 31st, 1916, 96 per cent. The turbo-generators, although contracted for to work at 3,000 KW. each, actually give 4,200 KW. continuously, and have done 5,000 KW. as a maximum. The steam consumption of the plant during the 2½ years has been at least up to the contract guarantee. The steam consumption per unit generated (including all losses) has been reduced from 21·17 lb. with the old plant to 16·84 lb.

with the new; the coal consumption has been reduced from 3·49 lb. (10 per cent. slack) to 2·87 lb. (42 per cent. slack) per unit. The saving in coal last year by the new plant was £6,534. Though the station and mains staff had no previous experience with this system of generation and transmission, no breakdowns had occurred. The actual expenditure amounted to £32,981 for plant and mains.

The Electricity Committee reports that women have been engaged to replace men wherever possible. One is employed as storekeeper at the generating station stores; with the exception of the chief technical clerk, all clerical work at the station is done by girls, and girls are now being engaged for the switchboard galleries at the generating and sub-stations. The Committee has appointed a lady as district representative in the sales department, and arrangements are being made for the employment of women as lamplighters, meter testers, and in any other capacity where they can replace men.

Luton.—EXTENSIONS.—The electrical engineer hopes shortly to be in a position to submit tenders for the additional boiler, economiser, and ash and soot-handling plant required in connection with the generating station extensions. The demand has increased 36 per cent. over the corresponding period last year. Applications in hand include 5,125 8 C.P. lamps for lighting; 376-H.P. motors, and 513 KW. for heating.

Manchester.—SUMMER TIME.—After a month's experience of conditions under "Summer Time," the electricity department anticipates a reduction of 550,000 units of energy at the Stuart Street station from May 21st until the end of September, equal to 1 per cent. of the total output of the station, and a reduction of 600 tons in the consumption of coal; at the city stations the reduction in output is estimated at 200,000 units, or 2 per cent., with a reduction in coal consumption of 300 tons.

Nelson.—The electrical engineer having reported on the engines at the electricity works, it was decided that no repairs be undertaken to the engine now disabled, and that a Sub-Committee be appointed to deal with any emergency that may arise in connection with the generating station.

Newton Abbot.—The U.D.C. has accepted an offer from the E.L. Co., of a reduction of £55 for discontinued lighting during June, July, August and September, the period of the contract to be extended for the time the lamps are not used.

Norway.—According to a recent official return, the number of electricity generating plants in Norway at the end of the fiscal year, 1915, amounted to 1,515, with a capacity of 649,127 KW., these figures comparing with 1,427 and 560,406 respectively at the end of the preceding twelve months.

Perth.—The balance on the year's work is fully £330 to the good, and there will be no increase in the charges.

Rawtenstall.—PRICE INCREASE.—The Electricity Committee has decided that the price of electricity to power consumers other than those under an agreement containing a coal clause shall be increased 5 per cent.

Ripon.—PROV. ORDER.—The City Council has decided to apply for a provisional order for the supply of electricity to the city.

Rochdale. — ARBITRATION. — Tyre Yarns, Ltd., of Castleton, have asked that a dispute between the firm and the electricity department respecting the interpretation of certain clauses in their agreement for the supply of electricity shall be submitted to the arbitration of the Board of Trade, and the T.C. has instructed the town clerk to take the necessary steps to this end.

Southend-on-Sea.—For some months past the Electric Lighting Committee has been in communication with the various contractors for the plant ordered for the proposed sub-stations at Leigh and Thorpe Bay, with the object of effecting an amicable arrangement to meet the difficulty which arose in consequence of the action of the L.G.B. in prohibiting the raising of loans by local authorities during the war. The plant ordered included five Diesel oil engines manufactured by Messrs. Bolliss and Morcom, Ltd., three 200-KW. dynamos manufactured by the Phœnix Dynamo Manufacturing Co., Ltd., and two 180-KW. dynamos manufactured by the British Thomson-Houston Co., Ltd., the amount of the accepted tenders totalling £16,359. With the exception of two six-crank engines, all the machines mentioned were ready for delivery last summer. The Committee has now succeeded in provisionally effecting an arrangement.

It was reported at the last meeting of the Lighting Committee, that a tradesman who carried out the work of cleaning the interior of various houses and also furniture by means of a vacuum cleaner, had, for the purpose of operating the machine, used the current supplied under the contract rate to such premises. The Committee resolved to charge the tradesman in question at the rate of 6d. for a period not exceeding three hours, or 1s. per day in respect of the current used for the purpose referred to, and that this rate be charged for all current used in vacuum cleaners where the consumption thereof does not exceed one quarter unit per hour.

The Committee appointed to consider the question of effecting economies in public expenditure expresses the opinion that it would be impracticable, at the present time, to reduce the amount of the estimate (£3,900) for street lighting during the current financial year. With the view, however, of lessening the future outgoings, it has advised the Corporation to request the Highways Committee to consider the question of substituting electricity for gas in the streets at present lighted by the latter.

Stalybridge.—PLANT EXTENSIONS.—L.G.B. sanction has been received by the Stalybridge, Hyde, Dukinfield and Mossley Tramways and Electricity Board, for the borrowing of £30,000 for extensions, and the work is to be put in hand at once.

Walthamstow.—The Lighting Committee of the D.C. has given instructions for the whole of the street lighting to be discontinued until the end of August. The Committee has recommended the purchase of automatic switches for the public lamps at a cost of about £450. The Finance Committee has approved of the expenditure, and recommends application for borrowing powers.

West Ham.—The electrical engineer has been authorised to proceed with the work of extending the supply of electricity to the works of the India-Rubber, Gutta-Percha and Telegraph Co., Ltd.

Westleigh.—Electrical plant to serve a variety of purposes is to be put down at the Parsonage Collieries, Westleigh, Lancs., belonging to the Wigan Coal and Iron Co., Ltd., who are sinking extensive new mines there. Additional electrical power is to be introduced at other collieries in the same neighbourhood.

TRAMWAY and RAILWAY NOTES.

Birmingham.—CAR DERAILED.—A serious accident occurred at Handsworth, on Thursday last week, 39 persons being injured, four of them somewhat seriously. The car was making the journey from Darlaston to the city with a full complement of passengers and had reached a point opposite Soho Road Station when, through an accident to the brakes, it left the rails, ran into the pavement, smashing the stones for many yards, and finally fell over on its side in the roadway. The passengers both inside and outside were thrown violently against each other, many being pressed downwards against splintered glass. Most of the injured, who were suffering from shock and bruises, were taken on ambulances to the general hospital. The majority were sent to their homes after receiving treatment.—*Morning Post.*

Blackpool.—Despite the abandonment of the Whitsuntide holiday, Mr. C. Farness, general manager of the Corporation tramways, reported on June 22nd that the tramway traffic practically held its own compared with last year. This he considers a very good result, for he was prepared to see a decline of about £1,500.

Brentford.—TRACK REPAIR.—The D.C. has decided to call the attention of the B. of T. and the Commissioner of Police to the noise made by the cars owing to the worn-out state of the track, with a view to pressure being brought to bear on the company to carry out repair work.

Huddersfield.—The Tramways Committee has agreed to a further amendment to the existing agreements to allow of their continuance until the conclusion of the war. The Committee has decided that men who are called up for military service before their holidays are due shall receive holiday pay, this applying to temporary men where they have been in the employment of the department for the necessary period.

Keighley.—After allowing for interest and sinking fund charges, the net revenue accounts for the tramways show a deficit of £168 for the year, and for railless trolley vehicles a surplus of £51.

Newcastle-on-Tyne.—YEAR'S WORKING.—The financial statement of the working of the Corporation tramways shows that for the past year the traffic expenses were £93,831, as compared with £79,328 for the preceding year. The increase of £14,503 was made up principally by increased wages and war bonuses to the traffic staff. Of the total traffic expenses, 87.40 per cent. represented wages. General expenses totalled £34,745, an increase of £9,165, of which rates alone accounted for £6,000. General repairs and maintenance had cost £38,055 against £31,120, an increase of £6,935. Power expenses at £17,436 showed an increase of £3,496, due to the higher prices of fuel and an increased consumption. On the maintenance of power and sub-stations £3,087 had been spent, as against £3,969. Public lighting, £4,320, showed a decrease of £760, attributable to the fact that in recent years new lamps had gradually been installed to supersede less efficient types. The total working expenses were £192,619, an increase of £32,191. The total income was £324,695, as against £293,264, an increase of £31,431. The traffic income of the undertaking was £314,732. The gross profit on the year's working was £132,046, which was increased by interest to £135,764. Out of this sum there had been paid £10,834 for income-tax (an increase of nearly 100 per cent.), £75,000 for interest and redemption of loans, £8,164 contribution to the rates out of profits, £13,144 allowances to men on active service and their dependents, and other smaller items, which left a net profit of £23,389 as against £24,822 in the previous year to be appropriated for the reserve and renewals fund, which now totals £77,000. During the past year there had been spent on renewals to the permanent way,

additions to plant and cable, and in the purchase of land £21,052, so that almost the whole of the surplus of the undertaking for the past year had been absorbed, and there was a net £2,000 in round figures to carry to the reserve and renewals fund.

Preston.—FARES.—The T.C. is to be recommended by the Tramways Committee to sanction the discontinuance of the issue of transfer tickets, and to agree to the issue of ½d. tickets on the present transfer stages.

Swansea.—The B.C. has approved of the recommendations of the Tramways and Electric Lighting Committee that the Council accept the Tramway Co.'s offer to convey the freehold of the power station, instead of the leasehold interest, and that the necessary steps be taken to carry the matter to completion.

Walthamstow.—The D.C. is recommended to put in hand at once the work of repairing the tramway track in Chingford Road.

West Ham.—FARES AND STAGES.—The Tramways Committee has reconsidered a recommendation, referred back at the last Council meeting, with reference to the adoption of a revised list of ½d. stages, and the substitution of 1½d. workmen's return tickets for the existing 1d. returns, together with certain resolutions adopted by the Leyton Tramways Committee, with reference to the revision of ½d. fares and the overlapping stages, or their abolition, and the revision of workmen's fares, which are considered to be too low. The Committee now recommends that in lieu of the previous recommendation, the following be adopted and carried into effect:—(1) A universal 1d. fare for a continuous journey on any one car within the borough; (2) children's stages to remain in force as at present; (3) a 1½d. workmen's return fare for a continuous journey on any one car within the borough—return tickets to be issued on all cars scheduled to arrive at a terminus before, and up to, 8 a.m.; (4) existing through fares, where necessary, to be adjusted to comply with the above scheme.

LOAN APPLICATION.—The T.C. is recommended to apply to the B. of T. for sanction to a loan of £1,000 to cover the cost of doubling the track at the Connaught Road terminus, and to advise the Board, in reply to their letter with regard to the possibility of postponing the whole, or a portion, of the scheme, that the matter is one of extreme urgency at the present time, due to heavy traffic from the docks and Arsenal, and should be completed as early as possible.

TELEGRAPH and TELEPHONE NOTES.

Hull.—The Corporation having applied for sanction to borrow £4,000, the L.G.B. stated that in the present circumstances it was undesirable to have recourse to borrowing. The telephone engineer explained that this was capital expenditure by the Post Office before the Council took over the telephones, and recommended that all capital expenditure from January 1st last should be met out of the reserve fund, and that in connection with all future new installations the subscribers be requested to defray the expense. The recommendation was adopted.

Argentina.—*La Electricidad y la Maquinaria* states that Alexander Schwimmer, the representative of a North American Syndicate, has applied to the Municipal administration for leave to set up an automatic telephone system in Buenos Ayres. The tariff which the promoters offer is 10 to 15 per cent. lower than the prices now charged by the Union Telefonico for the existing service.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—U.D.C. Cable. See "Official Notices" June 23rd.

Aberdeen.—July 7th. Corporation. One 5,000-KW. turbo-alternator with surface condenser and auxiliaries, for the Electricity Department. See "Official Notices" June 23rd.

Australia.—PERTH.—July 19th. P.M.G. Supply of insulators (Schedule 510). See "Official Notices" June 9th.

August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" June 16th.

MELBOURNE.—July 26th. Victorian Railway Commissioners. 400 signal lighting transformers.*

August 8th. Deputy P.M.G. Standard battery material:—Porous pots, jars, zinc and carbon rods, and chemicals. Sched. 1,327. High Commissioner's Office, 72, Victoria Street, S.W.

SYDNEY.—August 17th. Portable internal-combustion engine and dynamo (2½ KW.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

BRISBANE.—July 31st. P.M.G. Power board and accumulators. Schedule No. 381.

Barrowford.—July 8th. U.D.C. Automatic control electric screen-cleaning gear for the sewage disposal works. Mr. F. Sutcliffe, Surveyor to the Council.

Bradford.—Guardians' Union House Committee. Installing an adequate telephone system at Bowling Park Colony.

Leeds.—July 3rd. Electricity Department. Two overground transformer chambers at Holbeck, and one underground transformer chamber at Hunslet. Mr. C. N. Hefford, Manager.

Manchester.—July 11th. Electricity Committee. (*a*) Electric or hydraulic coal-wagon lift and turntable; (*b*) saddle tank steam locomotive. Specification, &c., 21s. (returnable), from Mr. F. E. Hughes, Secretary, Electricity Dept., Town Hall.

New Zealand.—INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office.

Plymouth.—July 20th. Corporation. Rotary steam boiler feed pump for the Electricity Department. See "Official Notices" to-day.

Rochdale.—July 12th. Electricity Committee. Paper-insulated cables for 12 months. Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Rotherham.—July 3rd. Corporation. Twelve months' supply of tramway stores and materials, coal, cable, meters, &c. See "Official Notices" June 16th.

Spain.—July 14th. The municipal authorities of Sollana (Province of Valencia). Concession for the electric lighting of the town during a period of five years.

Warrington.—July 11th. Electricity Department. 7,000 tons of slack coal for six months, or alternatively 12,000 tons during 12 months. Mr. F. V. L. Mathias, Borough Electrical Engineer.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Barnsley.—Electricity Committee. Contracts for coal: 4,000 tons, Wilby & Sons; 4,000 tons, Williams.

Bolton.—Electricity Committee:—

J. B. Scholes & Sons.—15,000 tons of Ellerbeck and rough Arley slack, and 2,500 tons of Roscow's (Peel Hall Colliery) rough slack, with option of further 2,500 tons.
Earl of Ellesmere.—5,000 tons of slack.

Brentford.—District Council. Automatic starters for the pumping station: Igranic Electric Co., Ltd.

Brighton.—Board of Guardians. Electrical fittings: H. J. Galliers, £35.

London.—Included in the tenders which have been accepted by the Metropolitan Asylums Board for the supply of general stores, &c., during the period ending June, 1917, is one from the General Electric Co., Ltd., for three items of the schedule.

ST. PANCRAS.—Borough Council. Tenders received for 1,000 yards of E.H.T. three-core cable, required for the supply of power to industrial works:—

Union Cable Co., Ltd.		£564
Western Electric Co., Ltd.	(accepted)	568
Pirelli-General Cable Works, Ltd.		579
Johnson & Phillips, Ltd.		590
B.I. & Helsby Cables, Ltd.		590
Siemens Bros. & Co., Ltd.		594
W. T. Henley's Telegraph Works Co., Ltd.		597
W. T. Glover & Co., Ltd.		608
Callender's Cable, &c., Co., Ltd.		632
Macintosh Cable Co., Ltd.		690

Subject to satisfactory sureties, the tender of Messrs. Beattie and Co., Ltd., for coal to the generating stations for one year has been accepted. The approximate estimated quantities for the respective works given in the schedule were 16,125 tons beans, 5,375 tons nuts, and 3,600 tons large hard steam. Messrs. Beattie's prices (£1 6s. 5d. for hard steam, £1 4s. 5d. for beans, and £1 5s. 8d. for nuts) are subject to any advance or reduction authorised under any alteration of the Price of Coal (Limitation) Act, to the Coal Exchange Strike, &c., Clauses, the Official Government Clause, and to the increase or reduction in railway rates and charges.

Rawtenstall.—2,000-KW. turbo-generator (G.E.C.), James Howden & Co., Ltd.; condenser plant, Mirrlees, Watson and Co., Ltd.

Southampton.—Messrs. Walton & Clough, contractors for the coal conveyors for the electricity works, have been authorised by the Ministry of Munitions to treat this contract as war work, provided it does not interfere with the output of munitions. Accordingly, two of the conveyors may be delivered in July.

Electricity Committee. Accepted tender:—A coal breaker, £148, Jenkins & Co.

Watford.—The Electricity Committee recommends the D.C. to enter into an agreement with Messrs. E. Foster & Co. for the supply of 45 tons a week of Kingsbury slack coal at 20s. 2d. per ton for a period of 12 months. The Committee also recommends the acceptance of the offer of the Tudor Accumulator Co. to renew their contract for a period of 10 years on the same terms as before.

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—To-day (Friday). At 2.30 p.m. See "Notes" to-day.

Physical Society of London.—To-day (Friday). At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

NOTES.

Electric Vehicle Committee.—A meeting of the Electric Vehicle Committee was held in London on June 16th, Mr. A. C. Cramb presiding, in the absence of Mr. R. A. Chattock. It was announced that for the present year the following had been nominated by their respective Associations to act as their representatives on the Committee:—

The Society of Motor Manufacturers and Traders.—Mr. T. C. Pullinger, of Arrol-Johnston, Ltd., Heathhall, Dumfries.

The Tramway and Light Railways Association.—Mr. W. T. Robson, general manager, Corporation Tramways, Southampton.

The Incorporated Association of Electric Power Companies.—Mr. J. S. Highfield, chief engineer, Metropolitan Electric Supply Co.

A Sub-Committee consisting of Mr. E. S. Shrapnell-Smith, Mr. E. W. Curtis, and the hon. secretary was appointed to draft a letter to the Board of Trade, with a view to getting electrical commercial vehicles excluded from any declaration that might be made prohibiting the import of foreign-made commercial motor vehicles.

The Committee's attention had been drawn to the fact that industrial electric trucks imported into the country were not being provided with the standard charging plug. The Committee was unanimously of the opinion that these trucks ought to be provided with the standard fitting, and the secretary was instructed to write to the manufacturers to this effect.

The date of the next meeting was fixed for Friday, July 28th, at 2.45 p.m.

Allied Labour Conference.—An important conference of Allied Labour Federations will take place at Leeds on July 5th and 6th to consider a lengthy programme on general Labour subjects affecting trade unions in the Allied countries. Representatives of the General French Confederation of Labour, and the Italian, Russian, and Portuguese confederations, will attend as the guests of the British General Federation of Trade Unions, whose annual conference will be held during the same week. Among the subjects to be discussed are:—An international eight-hour day, a general Saturday half-holiday, the Sunday cessation of labour, the industrial protection of women and labour, and an international approximation of laws relating to Labour. There will also be considered the question of stopping immigration from enemy countries, and the appointment of a Government Committee representing all sections of industry and Government departments.—*Daily Telegraph.*

Institution and Lecture Notes.—Diesel Engine Users' Association.—The June meeting of the Diesel Engine Users' Association was held at the Institution of Electrical Engineers last week.

MR. A. J. C. DE RENZI (Newcastle-under-Lyme) made a suggestion that the Association should hold one meeting in each year in an important centre outside London.

A motion by MR. H. LESLIE DIXON (Leatherhead), seconded by MR. C. O. MILTON (Maidenhead), that the Association should support the application of the Suffolk Electricity Supply Co., Ltd., to the Board of Trade for the voiding or suspension during the war of the German patent in regard to "Improvements in Internal-combustion Engines" to enable tar oils to be used as fuel, was discussed, and carried unanimously.

A paper was read by MR. GEOFFREY PORTER (president) on "Oil Engines and Steam Engines in Combination," in which he discussed the problems met with in extending a comparatively inefficient steam-driven generating station of about 1,500 KW. capacity, of which there are large numbers in various parts of the country. He dealt with the subject from the point of view of capital costs and working costs, and produced tables showing comparisons of actual results obtained by the introduction of Diesel engine plant at various works. All the examples of generating stations in which Diesel engine plant had been put down as an extension to the steam plant showed a remarkable diminution in working costs An important advantage of the Diesel engine over steam plant was that any irregularity or inefficiency in working became obvious at once, and could receive prompt attention, and the author was convinced that a Diesel-engine plant could much more readily be kept in good economical working condition than the average steam plant. The question of fuel oil supplies was one of the greatest importance, and the present war had opened their eyes to the manner in which this country had become dependent on others for absolute necessities. The fuel oil question could be, and would be, solved by their own chemists and engineers. Continental users and manufacturers of Diesel engines had used tars and tar-oils with success for many years, and they should do so too. In working their coal deposits they were living on their capital; the greater the reason, therefore, to use it to the best advantage.

The next meeting of the Association will be held on Wednesday, July 12th

The Tramway Congress in London.—To-day the eighth annual Congress of the Tramways and Light Railways Association is being held in the Westminster Palace Hotel (Room 1). The annual general meeting takes place at 2.30 p.m. At 3 o'clock, Mr. W. Tuke Robson (general manager, Southampton Corporation tramways) will read a paper on "Tramway Transit and Comfort: a Plea for the Passenger." After this has been discussed, there will, at 4 o'clock, be a visit by motor-'bus to the L.G.O. training school at Milman Street, Chelsea, where members will be received by Mr. H. E. Blain, operating manager of the L.G.O. and the Underground Railways. The class rooms, &c., will be inspected, and in the kinematograph hall special films will be exhibited showing London traffic schemes, with special reference to rules of the road for tramcars, 'buses, and other traffic, methods of training, &c. After tea Mr. Blain will give a short address on "The Safety Movement"; and in the evening the members' dinner will be held at the Trocadero Restaurant, at 7.30 for 7.45. Evening dress is optional.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, July 3rd.—Technical for Platoon No. 9, 46, Regency Street, S.W.; Squad and Platoon Drill, Platoon No. 10; Signalling Class and Recruits.

Tuesday, July 4th.—Officers' Training Class, 6 to 7; Recruits, 7; lecture, 7.15, "Constitution and Duties of a Field Company," Company Commander Bentley.

Wednesday, July 5th.—Platoon Drill, No. 2 Platoon.

Thursday, July 6th.—Platoon Drill, No. 6 Platoon; Recruits, 5.45 to 7.45; Instructional Class, 5.45.

Friday, July 7th.—Technical for No. 10 Platoon, 46, Regency Street, S.W.; Squad and Platoon Drill, No. 9 Platoon.

Saturday, July 8th.—Instruction Class, 2.30, Company Commander Fleming.

Sunday, July 9th.—Entrenching duties: Parade, Victoria (S.E. and C. Railway Booking Office), 8.35 a.m.

MACLEOD YEARSLEY, *Adjutant.*

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, June 29th, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Wembley Park at 3 p.m., under the Commandant. The Examination, Officers' Instruction Class, which was postponed from last Saturday, will take place on this Parade.

A party, as strong as possible, is required for Entrenching work on Saturday, July 1st. This party will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., and return to London by the 5.20 p.m. train.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties, returning to town about 6 p.m.

Public Regimental Recruiting Meeting at the Guildhall on Friday, 30th inst., at 12.30 p.m., presided over by the Lord Mayor.

Musketry.—Competitors for the "Holland Cup" who have sent in their names to shoot at Bisley on Sunday, July 2nd, will report in uniform to Sergeant J. W. S. Burmester, at 9.45 a.m., at No. 8 Platform, Waterloo Station.

All members who took part in the competition for the Cup presented by Brigadier-General the Hon. F. C. Bridgeman are requested to attend Saturday's Parade at Wembley Park.

G. H. F. DUNCAN, *Acting Adjutant*, O.B.C.

Professional Classes and the War.—A meeting was held at the Mansion House last week in furtherance of the objects of the Professional Classes War Relief Council, the Lord Mayor presiding. Cardinal Bourne placed under three heads the professional people who required temporary assistance: (1) Those dependent for their livelihood upon fixed salaries despite rising prices: (2) those who were not dependent upon fixed incomes, but were becoming increasingly prosperous before the war, and (3) those whose whole means of subsistence had been practically brought to an end owing to the war. Mr. Marshall Hall, K.C., M.P., was of opinion that among the classes concerned collective assistance was far preferable to individual aid. Dr. (Mrs.) Scharlieb dealt with the work of the Maternity Committee, and Sir William McClure explained the educational and musical work. Lord Justice Phillimore pointed out that the professional classes had done much for the country by enlistment and other national service, and were the greatest sufferers from the war. The Council had already relieved 7,000 cases, and most of the money had been subscribed by professional people less severely affected by the present economic conditions. A donation of £100 from Lord Loreburn was announced.—*Morning Post.*

Engineer Examiners.—It is announced by the Secretary of the War Office that 250 examiners of engineers' work are urgently required for service at home. The rates of pay are 50s. to 60s. weekly, plus allowance of 21s. weekly up to three months at one station; also a special war increase of 4s. a week, and overtime at common-time rates after 48 hours per week. Applications should be addressed, "Room 268, A. G. 2 B, War Office," enclosing credentials.

Appointments Vacant.—Junior engineers-in-charge, for the Newport electricity department (45s.); assistant, with experience of suction gas plant and overhead wiring, for the Holmfirth U.D.C. electricity works; chief assistant engineer and manager of the electricity undertaking (£160), for the Leek U.D.C. For particulars, see our advertisement pages to-day

London P.O. Engineering Department.—On Thursday last week the Postmaster-General opened new offices which have been erected in Denman Street, London Bridge, to accommodate the headquarter staff of the Post Office Engineering Department, London District, which numbers 350 members. At a meeting that was held on the premises, Mr. A. Moir, superintending engineer of the district, presided. Sir W. Slingo, engineer-in-chief, welcomed Mr. Pease and the secretary, Mr. G. E. P. Murray, and stated that the total expenditure of the department last year reached over 6½ millions sterling. The architect, Mr. E. Cropper, said the site covered 8,000 sq. ft., and the building consisted of seven floors, with a total area of 45,000 sq. ft. It was designed by his predecessor, Mr. Rutherford, and cost £26,000. The Postmaster-General said that the staff had been depleted by the war, and consisted of 160 men and 40 women; the old building now provided for three district engineers and assistants. The number of women employed on the engineering staff in the Metropolitan district had risen from 13 before the war to 141. The total number of all ranks in the district in July, 1914, was 5,541, of whom 2,132 voluntarily joined the Colours, 25 obtaining commissions; 58 had fallen in the war, and 68 had been invalided home. Seven had received the D.C.M. Since taking over the National Telephone Co.'s system the department had opened four large new exchanges and five smaller ones, and arranged for 19 others; 14,000 miles of O.H. wire had been removed, and 36,000 subscribers had been added. The staff now maintained 53 telephone exchanges and 12,000 private branch exchanges, and 251,142 telephones—one-third of the whole telephone service of the United Kingdom. Over 300 million calls originated in the area last year. There were in London over 600 telegraph offices, and the Central Telegraph Office dealt with one-third of the 91 million messages that were dispatched per annum. The total length of cables in the district was 70,849 miles, and the single-wire mileage was 1,037,790 miles. The cost of new construction and maintenance was over a million a year. The number of complaints received from the public had diminished from 1·25 per diem per 1,000 direct lines to 0·5. About 7,000 additional telephones had been installed for the War Office during the year, and 1,500 for the Ministry of Munitions. The work of the Post Office engineers had been accorded the highest praise during the war.

The secretary expressed appreciation of the work of the staff, and Mr. Moir replied, pointing out the advantages of the concentration of the staff, and presented Mr. Pease with a key with which he proceeded to open the new building.

Accident.—Whilst James Lancaster, an electrician, of Shipley, was engaged last week in filing a nut at the rear of a switchboard on the electrical equipment at Briar Field Mills, Shipley, the file came into contact with a live wire, which fused. Lancaster's clothes caught fire, and he was severely burnt about the face and hands, and suffered from shock. After first aid had been rendered he was taken to hospital and detained there.

Foreign Languages.—The Senate of the University of London has elected a Professor of the Spanish language.

Sir James Roberts, Bart., has offered £10,000 to the Leeds University for the establishment of a Professorship of Russian language and literature, and the offer has been accepted.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Having been offered, and accepted, another appointment, Mr. W. H. ALLEN has resigned the post of engineer and manager of the Loughborough Corporation electricity department, which he has held since the inception of the undertaking, some 12 years ago.

A Yorkshire paper states that Mr. A. B. MOUNTAIN, the borough electrical engineer of Huddersfield, has resigned his position, and, on the recommendation of the Electricity Committee, the Huddersfield Town Council has decided that the following arrangements shall come into operation on September 1st:—Mr. Mountain to be consulting engineer, up to December 31st, 1919, at £300 per annum and expenses; Mr. J. W. Turner to be borough electrical engineer at £400 per annum (his present salary is £250); Mr. E. Lunn, station superintendent, to have his salary increased from £240 to £265; Mr. J. A. Swift, commercial assistant, to have his salary increased from £200 to £225; and Mr. Phillips to be appointed mains foreman at £182 per annum.

Nuneaton T.C. has granted a war bonus of £40 a year to the acting electrical engineer during the absence of the electrical engineer on military service.

Huddersfield T.C. has advanced the salary of its tramway manager, Mr. R. H. WILKINSON, from £400 to £500 per annum.

Mr. C. L. E. STEWART, borough electrical engineer of Rawtenstall, is laid up, but it was stated at the Council meeting last week that he was much better.

On the occasion of his marriage, Mr. JOHN DOWNIE, chief clerk of the Aberdeen Corporation electricity works, was last week met by the staff and employés and presented with a barometer and clock. Mr. Bell made the presentation, and Mr. Downie suitably replied.

General.—In May, Prof. J. H. DOBSON, general manager of the gas, electric supply and tramways department of the Johannesburg Municipality, left on active service with the Forces for the German East African campaign. He has been appointed officer commanding, South African Pioneer Battalion, with the rank of major.

At Blackpool, on June 21st, the marriage took place of Mr. WM. H. MILLER, A.M.I.E.E., of Belfast and Fleetwood, and Mrs. F. Browne, widow of Mr. Frank Browne, of St. Helens and Liverpool.

The marriage took place at Wellington, New Zealand, on June 10th, of Mr. WILSON ORMROD, A.M.I.E.E., and Miss E. B. Bean, only daughter of Capt. Fredk. T. Bean, of the Bedfordshire Regiment, of Clapham Common, S.W.

The *Times* states that "an engagement is announced between Mr. GEORGE VERITY, J.P., hon. colonel, R.E. (T.), of 7, Basil Street, S.W., and Mrs. Charles Hamilton Walter, of 35, Hyde Park Gate, S.W." Mr. Verity is, of course, the chairman of the well-known firm of Veritys, Ltd.

Mr. J. J. LIGHTFOOT (secretarial department), County of London Electric Supply Co., has been gazetted as second-lieutenant, Royal Engineers (T.), Wireless Section.

Mr. H. G. PRICE has resigned his position as secretary of the Nottingham Society of Engineers, and a successor is being advertised for at £25 per annum.

Roll of Honour.—Amongst those mentioned in dispatches for gallant and distinguished conduct in the field is the late Private W. R. JENKINSON, of the 13th Cheshire Regiment, who, before the war, was an electrician at Port Sunlight, Birkenhead. He fell in action last January.

Private WALTER ASHCROFT, of the Loyal North Lancashire Regiment, formerly employed at the Bolton electricity works, has been killed while on sentry duty.

Sergeant S. LEVEY, of the Rifle Brigade, formerly employed by Messrs. Hans Renolds, Ltd., Manchester, has been killed in action, aged 25.

Private J. A. WARREN, of the King's (Liverpool) Regiment, formerly employed at the Chloride Electrical Storage Co., Clifton, has died from wounds, aged 29.

Lance-Corporal E. W. ICKE, of the Manchester Regiment, formerly employed at the British Westinghouse Works, Trafford Park, has been wounded by a rifle grenade.

Private J. BOND, of the Royal Canadian Highlanders, who has died of wounds, was formerly employed as an electrician by the Lancashire & Yorkshire Railway Co.

Private T. BULLOCK, of the Highland Light Infantry, formerly with Messrs. Taylor, Tunnicliffe & Co., electrical china manufacturers, of Eastwood, Hanley, has been killed in action.

Private J. MILLINGTON, formerly on the staff of the Potteries Electric Traction Co., has been killed in action. He served through the South African war.

Seaman ROBERT CHANT, of *H.M.S. Invincible*, who lost his life in the North Sea fight, had been in the employ of the Lancashire Dynamo Co., Trafford Park.

Corporal ARTHUR DAVY, of Urmston, previously reported missing at Gallipoli, and now officially reported killed, was 25 years of age, and, prior to the war, was assistant secretary to the general manager of the British Westinghouse Works, at Trafford Park.

HIRAM HART, an electrical fitter, formerly in the employ of Bolton Electricity Committee, has been killed on active service.

HAROLD WILLSHER, wireless telegraphist on the *Tipperary*, who was presumed lost in the North Sea battle, is a prisoner in Germany.

Second-Lieutenant WALTER J. CRIDGE, of the 15th Sherwood Foresters, was wounded in the face recently in France, and he is now at the 4th Northern General Hospital, Lincoln, where he is going on well.

Sergeant-Major O. LAING, 21st County of London Regiment, 1st Surrey Rifles, has been awarded the Military Cross for an act of great gallantry in saving a wounded comrade. Sergeant-Major Laing was on the staff of Messrs. M. Bateman and Co., of Brooke Street, Holborn, and was known to many houses in the lighting industry.

The following casualties among men of the County of London Electric Supply Co., Ltd., with the Forces are reported:—Private H. BEAZLEY, 9th Battalion (Buffs) East Kent Regiment, killed in action; Lance-Corporal E. CAPON, 5th Royal Berkshire Regiment, wounded, March 11th; Chief Petty Officer A. GARDEN, Royal Navy, died of injuries (North Sea); Private T. HYAM, 9th Battalion (Buffs) East Kent Regiment, killed in action; Private R. REEVES, 9th Battalion (Buffs) East Kent Regiment, killed in action.

Private H. F. GILL, Royal Engineers, Wireless Section, secretarial department, County of London Electric Supply Co., has been awarded the Military Medal for services in the field.

Obituary.—MR. W. TODHUNTER.—Mr. W. Todhunter, a member of the electrical staff of the Telegraph Construction and Maintenance Co., Ltd., who, as stated in our last issue, passed away on June 19th at the comparatively early age of 59, was born at Emsworth, Hants. He was educated at Blackheath, and, like most of the Todhunters, showed an

aptitude for mathematics. He joined the company's service on board the *Great Eastern* in 1873, and remained with them up to the time of his death. His first submarine cable expedition was in 1874, when he assisted in the laying of the Anglo-American cables. He has also been principal assistant on cable expeditions to all parts of the world until 1907, when he took charge of the electrical department in repairing and renewing the Eastern Telegraph Co.'s Bombay-Aden, Durban-Mozambique cables and numerous repair expeditions for various telegraph companies. His last expedition was laying the duplicate New York-Guantanamo-Colon cables for the Central & South American Telegraph Co. With his experience of over 43 years, his death is a severe loss to the electrical department of the company. He was much admired as a genial companion, and respected by all whom he met in the course of his career. He has been a member of the Telegraph Cable Masonic Lodge since 1903. The funeral took place on Saturday last at Shooter's Hill Cemetery.

MR. W. J. COCKRAM.—The death has taken place, from pneumonia, of Mr. Wm. James Cockram, electrical engineer, of Barnstaple, aged 53 years. Deceased was for some years in business in the town.

MISS ISABELLA FARADAY.—The *Times* records that Miss Isabella Faraday, a descendant of Michael Faraday, has died at Kirkby Stephen. Miss Faraday founded the Michael Faraday Homes near Warlingham, Surrey, where over 100 old people are housed.

MR. MARK BROWN.—The funeral took place at Blackpool Cemetery, on June 21st, of Mr. Mark Brown, foreman arc lamp trimmer at Blackpool Corporation electricity works, where he had been employed for 22 years. Mr. Chas. Furness, electrical engineer, and a number of fellow workmen attended.

MR. WILLIAM HANNING.—According to the daily Press, Mr. William Hanning, a former president of the British Chamber of Commerce in Paris, who was well known in engineering circles both in England and in France, died in Paris on Sunday.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

The report for the year ended December, 1915, states that there was a gross profit of £581,125 for the year, and that the net profit was £377,818, which is better by £145,101 than for 1914. Including £69,497 brought forward, the amount is £447,315. There is still no agreement with the Government as to the basis of remuneration and compensation for the use of the company's high-power stations since the beginning of the war and for other services rendered in connection therewith. It has, therefore, again been impossible to include in the accounts any sum in respect of these matters. A large number of contracts have, however, been entered into with Government departments, for all of which payments have been regularly received. It is stated that sums are payable by the Government to the company under the following four heads:—

1. The Post Office, for remuneration and compensation in respect of the use of the company's high-power stations since the beginning of the war, the staffing and management of those stations, and other services in connection therewith. (It is hoped that a substantial payment on account may be received shortly.)
2. The Admiralty, for the use of the company's patents since the expiration, on March 31st, 1914, of the Admiralty agreement of 1903, no new agreement having yet been concluded. (There have been difficulties in arriving at a settlement of this matter and delay has been unavoidable. We have, therefore, received an assurance that every dispatch will be given to deal with the matter as quickly as possible.)
3. The War Office, in respect of the use of the company's patents, without agreement, during the whole time wireless telegraphy has been used by the War Office. (This matter is about to be referred to the Treasury for settlement under the Patents and Designs Act, 1907.)
4. The Post Office, for compensation in respect of their withdrawal from the contract for the Imperial chain of stations, with regard to which no agreement has been arrived at, and the company has therefore been obliged to leave the amount of compensation to which it is entitled to be settled by a court of law.

Shares in associated companies and patents are taken at their cost price, viz., £1,383,658, which shows an increase of £23,532. The company's holdings in associated companies, except for some additions, have undergone no change during the past year. The par value of the shares held in associated companies now stands at £2,484,370, exclusive of shares which have no capital denomination. After crediting £100,000 allocated from profit and loss account of the preceding year, the general reserve account now stands at £967,530.

The Marconi International Marine Communication Co. has continued to show substantial development of its business and a further increase in profits. Dividends for the past year amounting to 12½ per cent. have been declared, and £33,842 has been carried forward.

The Russian company, Société Russe de Télégraphes et Téléphones sans Fil, has continued to do a large business. A dividend at the rate of 15 per cent. for the year 1915 has been declared.

The French company, La Compagnie Française Maritime et Coloniale de Télégraphie sans Fil, has declared a dividend for the year 1915 at the rate of 10 per cent. on the ordinary shares and 31.25 francs on the founders' shares.

The Amalgamated Wireless (Australasia), Ltd., has paid a dividend of 6 per cent. for the year.

The Wireless Press, Ltd., has paid a dividend of 25 per cent. in respect of the year.

The Marconi Wireless Telegraph Co., of America, has again earned increased profits for the past year, but its principal revenue is expected to be derived from the trans-Atlantic service, which, in consequence of this company's stations being in Government service, has been obliged to remain idle. It is apprehended that the compensation to be received in respect of this company's Carnarvon stations will also embrace the loss incurred by the enforced idleness of the American stations.

Owing to the unfavourable rates of exchange, large sums of money have had to be placed on deposit with foreign banks, principally in allied countries, until such time as the exchanges become normal. Had these moneys been remitted on December 31st last there would have been a loss in exchange of £25,757. Temporary investments at the end of the year showed a depreciation of £27,606. It has, therefore, been deemed right to debit to profit and loss account both these sums, which amount to £53,363. There have since been substantial improvements, and it is contemplated that if held until hostilities cease the loss will be completely recovered. In the event of eventual realisation without loss, the amount so written off will appear as profit in another year. In view of the state of war, and having regard to the large sums of money abroad, and to the uncertainty as to when any of the moneys due to the company from the Government will be received, the directors deem it prudent to husband their resources, and recommend the declaration of a final dividend upon the ordinary shares at the rate of 5 per cent., which, together with the 5 per cent. interim dividend paid on February 1st, 1916, will make 10 per cent. for the year. They will, however, further recommend that a substantial bonus shall be declared and paid out of the moneys due from the Government as soon as they are received.

Annual meeting: To-day.

Aluminium Corporation, Ltd.

MR. S. G. BIBBY presided, on June 22nd, at the annual meeting. He said that the difficulties referred to at the last meeting were eventually successfully overcome, although the first six months of the year were better, as regarded output and profits, than the following half, due to the drought and shortness of their water supply. This was not likely to occur again now that they had been successful in tapping the Dulyn water. The boring of the tunnel was completed in April last, and they were now reaping the benefit of the Dulyn water, and already it was making all the difference as regards output, this having increased by approximately 30 per cent. during the five months of the current year as compared with the same period of 1915. The more water they could control the greater the output; the Dulyn tunnel had amply justified its construction. As the shareholders only gave a meagre response to the offer of debentures, they had to arrange for temporary loans. Loans appeared at £28,000 in the accounts, but they had been reduced since the close of the year to £15,000. Loans to subsidiary companies had increased by £6,442, these advances being made to enable the subsidiary companies to increase their output, so as to cope with this company's increased consumption. An Act of Parliament would be applied for shortly for simplifying the capital account. Having regard to their present position and prospects, they recommended that a start be made to reduce the accumulating preference stock dividend by paying 7 per cent., less income-tax. Their faith in the company has justified itself, and during the past year it had proved itself to be a national asset. Conditions were extremely abnormal in consequence of the demand for aluminium. That need not worry them, however, as recent developments of new uses would have the effect of increasing the demand and consumption when they returned to normal peaceful times. The abnormal demand had created a much higher selling price than before the war, but the cost of production had very considerably increased. There had been serious difficulties as to their supplies of raw materials, labour, freights, &c., and all these had told heavily again them, and they were likely to be still further increased as long as the war lasted. The Treasury had approved of their increasing the debenture issue, and they were now negotiating for the placing of a further £100,000 6 per cent. debentures to rank *pari passu* with the existing issue. This would give the funds for proceeding with the erection of the Cowlyd and Trasbwll dams, which were essential to increased output, and would treble the water storage. An additional pipe line was absolutely necessary, and would be proceeded with as soon as practicable. Arrangements had been made for the installation of a new generator, and work had been commenced upon a bridge over the River Conway, enabling them to bring the L. & N.W.R. direct into the works. They were doing their best towards placing the company upon a sound and substantial dividend-earning basis, and the present year promised to be one of considerable progress.

James Keith & Blackman Co., Ltd.

MR. T. W. ALSOP, presiding at the annual meeting recently, said that the balance sheet was not an unsatisfactory one. The business done was a record, 18 per cent. more than in 1915, notwithstanding the decrease in lighting, which was an important part of their business. The dividend was 10 per cent. free of income-tax—practically 12 per cent., and they were wiping goodwill and patents out altogether. They were increasing the reserve to £40,000. In the carry-forward of £12,056 they had provided for excess profits tax. Orders were being maintained; the works were now ready for anything of a profitable nature which might come along; and they looked forward with hope

and confidence to a steady, successful, and secure future. Mr. JAMES KEITH, the managing director, who followed, said that while the lighting department of the business diminished at home, owing to the Government restrictions, the turnover had largely increased in other directions. They began the current year well. They had had to get a lot of new and special machinery for urgent Government requirements, but they had been careful only to obtain such machinery as would be necessary for their regular and special work long after the war would be over. Their present principal trouble was in getting and retaining skilled workmen. All in the Empire must now and henceforth so organise as to effectively bar business relations with, and unfair competition from, the Huns and their relations.

Lancashire Power Construction Co., Ltd.

DR. H. F. PARSHALL, presiding at the annual meeting on June 22nd, said that the progress of the Lancashire Electric Power Co., in which they held all the shares and debentures, had been very satisfactory, with a substantial increase in the profit on trading. As to the first five months of the present year, the results were appreciably better than those for 1915, and if progress was maintained during the whole of 1916 the trading profit would be substantially better. From an engineering point of view, the progress had been comparatively uneventful. No addition had been made to the power plant, which had worked economically and well throughout the year. With regard to mains, they had extended them, and the system generally had been reinforced and consolidated, and therefore there was no large capital expenditure for them to face in order to keep up a sufficient supply. The outlook for future business was good, and on terms more consistent with the advantages given by the company and than those which had so far been obtained. It was not necessary for him to mention specific contracts, but there were several of importance. The units sold during the year showed a substantial increase over those sold in 1914, as did also the revenue. The growth of business with local orders showed an increase, but not as great as might have been anticipated, owing to the restricted lighting regulations. Still, the increase showed that their investment in those local orders would ultimately be a profitable one. The cost for fuel per unit sold was greater than in 1914, the increase being due to the higher price of fuel, but the total operating costs had been reduced, although there had been an increase in the rates. While on the subject of generation, he desired to point out that the Government appeared to be favourable now to a central supply system. In the past they had certainly not been given much consideration in that connection, and local authorities which could not generate as cheaply as the company had been allowed to go on with generating systems when, in the interests of the public or of economy, they should have come to the company for a supply. They had most pleasing and satisfactory relations with some of their larger neighbours, but some of their smaller neighbours had been very anxious to go on with their own undertakings, even at a loss. It was satisfactory to know that the principle of centralisation, after all these years, was now being recognised in a practical way by the Government, for he thought it could be said without fear of dispute that generation in England was more wastefully carried on than in any country in the world; that was to say, the relative cost of fuel per unit generated was vastly greater than in any other country. That was due to the fact that almost every local authority had been allowed to set up its own undertaking. In London half a million tons of coal were wasted yearly. If the principle of centralisation became generally adopted, their Lancashire undertaking would become a very important one, because they were in the centre of the district, with every facility for extension and generating on the most economical lines—and they could attain to very much lower generating figures than smaller undertakings less favourably situated. Owing to the handicap of not being, he feared, as favoured as the local authorities, they had had to feel their way, going on with small generating units, and, as a result, their fuel economy had not been as low as it might have been if they could have gone ahead at full speed from the beginning. Their fuel consumption, however, was lower, considering the class of fuel they were using, than of most other similar undertakings in the kingdom. Although they might have been in a better position had they been allowed to go ahead with bigger units, yet, as they stood to-day, they were very favourably situated to give a proper supply if they became the nucleus for giving a general supply in their district. They were proposing to extend their power station by the addition of another large generating unit to meet the general growth of their business and to give a safe margin for the continuify of the supply. The expenditure had been approved by the Government authorities, who had also approved the ordering of this machinery, and they were able to carry out the extension without asking for any new capital. When this unit was in working order they might expect an improvement in their cost of generation—at least, in their coal consumption; and they could also safely say that on the present basis of working, this unit would take them up to the point where they would be earning their fixed charges something like three times over. They had a considerable issue of profit-sharing notes. He thought that a dividend on them would be forthcoming when the new unit was fully employed, because they could then pay a fair dividend and, at the same time, have a sufficient margin over for carrying on the business. Having regard to the present general financial situation, he thought they must provide for necessary extensions out of earnings.

Globe Telegraph & Trust Co., Ltd.

The net revenue for the year ended May, 1916, after deduction of expenses, amounted to £226,086, plus £27,655 brought forward. £122,932 has been distributed in interim dividends, leaving £130,808. A final dividend of 3s. per share, less income-tax, on the preference shares makes 6 per cent. for the year; 8s. per share is to be paid, free of income-tax, on the ordinary shares, making 7 per cent., free of tax, for the year. The balance to carry forward will be £36,849. It is proposed that the directors' fees shall be paid free of income-tax. Annual meeting: July 4th.

Waygood-Otis, Ltd.

MR. H. C. WALKER, presiding at the annual meeting, said that one part of their works was occupied for the Government, to the detriment of operations in the other part. They had met with loss on a number of contracts, some of large amounts, which were placed at pre-war prices, but which, owing to the delay in building work generally, were hung up, or had had to be completed at the advanced costs of labour and material due to the war. They were obliged to carry out their undertakings though involving considerable loss. The speaker said that he did not regard the present state of affairs with any apprehension. When they were able to resume normal business they would be able to do it with conspicuous success, and he hoped that they would soon be able to pay the arrears in the preference dividend.

Hart Accumulator Co., Ltd.

The report for 1915, presented at the annual meeting held at Stratford on June 22nd, stated that the profit was £10,331, plus £11,394 brought forward. The dividend on the preference shares requires £423, and a dividend of 5 per cent., free of income-tax, on the ordinary shares absorbs £4,353, leaving £16,949 to be carried forward. Buildings, plant, tools, &c., have been augmented by £1,285, which has been charged to capital, and due depreciation on same has been made. The maintenance of the works, plant, &c., has been kept up at a cost of £1,697, which has been paid for out of revenue.

Anglo-Argentine Tramways Co., Ltd.—With reference to our paragraph of last year, the circular issued to the second preference shareholders reads:—"The directors regret that owing to increased expenditure, due to the abnormally high cost of fuel, it would be inexpedient at present to declare an interim dividend on the 5½ per cent. cumulative second preference shares for the half-year ending June 30th. The board entertains no doubt that when normal conditions again prevail regular payment of dividends on these shares will be resumed and arrears paid."

J. Stone & Co., Ltd.—The report for the year ended December 31st shows a profit, after full allowance for depreciation and provision for special Government taxes, &c., of £133,157, plus the balance brought forward of £189,039, making a total of £322,197. The directors recommend a dividend of 10 per cent. per annum and a bonus of 3s. per share on the ordinary shares, leaving £207,147 to be carried forward. —*Financial Times.*

Consolidated Electrical Co., Ltd.—A dividend of 2½ per cent. on the ordinary shares for the year is announced. The income for the year ended March, 1916, was £5,437, as compared with £5,344 for the previous year. The general charges were £1,215, compared with £1,191. The directors record the death of Mr. T. Taunton, who had been secretary from the company's formation.

Shawinigan Water & Power Co.—There is to be offered to shareholders $1,361,250 of new stock, the Treasury having given permission.

Stock Exchange Notice.—The following have been ordered to be quoted in the Official List:—

Barcelona Traction, Light & Power Co., Ltd.—£436,700 7 per cent. 50-year prion lien "A" bonds, Nos. 1 to 4,367, of £100 each, in lieu of the scrip.

STOCKS AND SHARES.

TUESDAY EVENING.

Investment markets in the Stock Exchange have come to something of a halt in the matter of business. This is partly due to the difficulty that there is in obtaining stock, and also to the inclination on the part of investors to await further developments from the various war theatres. Everyone has heard some of the highly interesting rumours which have been current in the City during the past few days, but of the truth of these no confirmation has been received. Expectation, however, stands on tip-toe; and, meanwhile, Stock

Exchange interests must be content to look after themselves to a large extent. The price of Consols shows a tendency to rise once more; and the industrial market of the Stock Exchange attracts more interest than any other part. A gratifying feature is a respectable series of advances in price amongst electricity supply shares.

More than half the shares in our list of electricity companies show rises, the improvements ranging from 1s. 3d. to 5s. From this, it might have been supposed that there was an active business being done in them. In point of fact, however, the number of shares changing hands is very small. Proprietors decline to sell, and, at the same time, there is a steady demand from investors who have noticed that this is one of the few sections which has hitherto failed to respond to the investment movement. Jobbers complain that there are no shares about, and that they have only buyers.

We reminded holders of the convertible debenture stock of the Consolidated Gas, Electric Light & Power, of Baltimore, last week that they should observe that the time for converting their debenture stock into common shares expires to-morrow (July 1st). Since then, the price of the stock has risen from 90 to 95, while the shares spurted from 110 to 120, there having been some little reaction from these prices. The shares, it need scarcely be said, are of the semi-speculative order, while the debenture stock is a first-class security of its kind, so that its holders may feel that they would prefer to retain this rather than exchange into shares of a more volatile description.

The price of the debenture stock has been run up on the conversion rights, and, when these expire, probably the price of the debenture will gracefully decline. Therefore the holders of the debenture stock, though they should feel disinclined to convert into common shares of the company, may be advised, even at this eleventh hour, to realise their stock, with a view to re-investing the money in something of the still more gilt-edged variety, which also stands a good chance of improving in price.

The Shawinigan new issue is now out, and the Treasury has given consent for holders on this side to subscribe for their proportion, which is one new share for every 10 now held, to be paid for at 115. A distinct novelty is introduced into this issue by the company's giving option certificates whereby those holders who do not wish to take up their shares now, may defer doing so until next April, when they will have to pay 120 if they elect to take up the shares at that time. Last year's dividend was 6¼ per cent., and the company is doing well. These American utility companies, by the way, are considerably to the fore at the present time, a jump of about 75 points within less than a fortnight in Cities Services shares having attracted mild interest and attention to the group as a whole.

Brazilian Tractions are a disappointing market, the price having given way 1½ points to 61½, notwithstanding the fact that the Rio exchange is well maintained in the neighbourhood of 1s. 0⅛d. Other Brazilian stocks are mostly firm, so that the decline in Tractions is taken to suggest that there may be something of a tap on hand, and that until it is turned off the price of the shares will remain depressed.

The Mexican group is weak. Few suppose that there will be open war between the States and Mexico, but events are moving rather rapidly now, and the situation is obviously very strained. The revolutionaries—or whatever Carranza and his friends style themselves—appear to be respecting private property, as, indeed, they have done hitherto. But it is quite comprehensible that holders of Mexican securities should feel anything but happy at the unexpected and uncomfortable turn which affairs have taken.

Anglo-Argentine Trams keep steady, despite the directors' decision to postpone payment of the interim dividend on the second preference shares. This is rendered advisable by reason of the increased expenditure due to the abnormal cost of fuel.

The Marconi report came out at the end of last week. The directors have decided to repeat last year's dividend payment of 10 per cent., but they hold out hopes of a substantial bonus at the end of the year. The immediate effect was a fall in the price of the shares to 2⅝. Profit-takers hurried in to scalp their gains while they could. Directly this bout of selling was over, a sharp rally occurred, the price being taken up to 2¾, so that on the week there is a net improvement of 3s. 9d. The other shares of the Marconi group are also higher, with the exception of Marines, which, after touching £2, eased off to 37s. 6d.

The Home Railway market has fallen upon quiet days, though to-day's rise in Consols helped prices considerably. Metropolitans fell ¾, Underground income shares ⅛, and others in this division were similarly dull. Central London stocks are still wanted, and the prices well maintained, the assented ordinary again exhibiting an improvement.

This remark applies also to the prior-charge issues of the various lines, steam and electric both. The best-class debentures have been forced up to a level at which the return is barely 4¼ per cent. on the money, or ¼ per cent. less than the Government is now offering on Exchequer Bonds. The inference obviously is that there are people looking for such a drop in the value of money after the war as shall justify them in taking a lower rate nowadays upon an irredeemable security, than they can get from a Government bond terminable within a few years. As to which, of course, he who lives longest will see most—or his children will.

Babcock & Wilcox have risen 5s. to 3. Castner-Kellners are ⅛ higher, following upon their rise of 3/16 last week, at 3¾. British Aluminium lost sixpence, but British Westinghouse preference are 1s. 6d. better, while other things in the manufacturing list are decidedly hard in tone. India-Rubber shares are 15s. up, and Electric Constructions are 9d. to the good. General Electric preference hardened to 9¾.

The Telegraph market pursues the even tenour of its rising way. There was a slight reaction towards the end of last week, but what little stock came to market was avidly snapped up, and every change which we record is again in the upward direction. Eastern ordinary has gained 3 points, and Eastern Extensions at 14¾ are 7s. 6d. higher. Globe ordinary and preference have moved with the rest of the market; and were it not for the difficulty of supplying the requirements of the buyers, there would be a free and good market in the whole list.

This week dealings have started in the new stocks of the British Electric Traction Co. The common is quoted at 37-39, and the 6 per cent. preference stock at 79-80. The latter looks quite a fair stock of its kind, and the yield at the present price comes to 7½ per cent. on the money, so that there would appear to be scope for appreciation. The debenture stocks, of course, remain the same as before, and the quotation for the Firsts is 81, while that for the Seconds is about 10 points lower.

The rubber share market is slightly better than it has been lately. For this the issue of another batch of excellent reports and good dividends is responsible, because the price of the raw material continues to afford little stimulus to purchases. Further weakness has occurred in copper shares in consequence of the dulness in the metal; but the armament group is sympathetically strong with most of the shares in the iron and steel market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price June 27, 1916.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	10	6¾	+ ½	£7 18 2
Charing Cross Ordinary	5	5	8¼	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	8¼	—	6 18 6
Chelsea	5	4	8	—	6 13 4
City of London	9	8	12½	+ ⅛	6 12 0
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 3
County of London	7	7	10½	+ ¼	6 13 4
do. 6 per cent. Pref.	6	6	10⅝	—	5 15 8
Kensington Ordinary	9	7	5⅛	+ ⅛	6 16 7
London Electric	4	3	1 5/16	—	7 11 0
do. do. 6 per cent. Pref.	6	6	4¼	+ ¼	6 13 4
Metropolitan	3½	3	2⅝	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	8⅛	+ ⅛	7 4 0
St. James' and Pall Mall	10	8	6	+ ⅛	6 13 4
South London	5	5	2⅝	—	8 18 10
South Metropolitan Pref.	7	7	1⅛	+ 1/16	6 4 6
Westminster Ordinary	9	7	6⅛	+ ⅛	5 14 3
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	106	+2	5 13 2
do. Def.	30/-	33/6	23	—	7 10 9
Chile Telephone	8	8	6¼	+ ⅛	6 3 1
Cuba Sub. Ord.	5	5	7½	—	6 13 4
Eastern Extension	7	8	14⅜	+ ⅜	*5 8 4
Eastern Tel. Ord.	7	8	149	+3	*5 7 7
Globe Tel. and T. Ord.	6	7	12⅞	+ ⅛	*5 10 0
do. Pref.	6	6	10¾	+ ¼	5 11 7
Great Northern Tel.	22	22	37	—	5 19 0
Indo-European	13	13	49	—	5 12 8
Marconi	10	10	2⅝	+ 3/16	3 7 6
New York Tel. 4½	4½	4½	102⅛	—	4 7 10
Oriental Telephone Ord.	10	10	2	+ 1/16	5 0 0
United R. Plate Tel.	8	8	6⅛ xd	+ ⅛	*6 3 1
West India and Pan.	1	N	20/-	—	9 6 1
Western Telegraph	7	8	15⅛	+ ⅛	*5 5 8
HOME RAILS.					
Central London, Ord. Assented	4	4	73	+1	5 9 7
Metropolitan	1¾	1	26¾	— ¾	3 14 9
do. District	Nil	Nil	19½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1 13/16	— 1/16	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	6	6	87⅛	+ ½	*6 17 0
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	+ ⅛	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	3 1/16	—	7 9 2
do. 2nd Pref.	5½	5½	3⅝	—	8 9 2
do. 5 Deb.	5	5	77⅛	— ½	6 9 0
Brazil Tractions	4	4	61⅛	- 1½	6 10 0
Bombay Electric Pref.	6	6	10⅝	—	5 15 8
British Columbia Elec. Rly. Pfce.	5	5	60	+ 1	8 6 8
do. do. Preferred	—	Nil	40	—	Nil
do. do. Deferred	—	Nil	39	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	40	—2	Nil
do. 6 per cent. Bonds	—	Nil	34	—1	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	32	—	Nil
do. 1st Bonds	Nil	Nil	41	—1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	3	+ ⅛	5 0 0
British Aluminium Ord.	5	7	26/-	—6d.	5 7 8
British Insulated Ord.	15	17½	10½	—	7 9 10
British Westinghouse Pref.	7½	7½	48/-	+1/6	6 5 0
Callenders	15	20	12½	—	8 0 0
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	3¾	+ ⅛	5 6 8
Edison & Swan, £3 paid	Nil	—	10/6	—	Nil
do. do. fully paid	Nil	—	1½	—	Nil
do. do. 5 per cent. Deb.	5	5	57	—	8 15 8
Electric Construction	6	7½	15/3	+9d.	9 16 8
Gen. Elec. Pref.	6	6	9¾	+ ⅛	6 3 1
Henley	20	25	15	—	8 6 8
do. ½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	19½	+ ¾	*6 8 4
Telegraph Con.	20	20	89	—	*6 4 0

* Dividends paid free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1916.

In comparison with the returns for the preceding month, the May figures for electrical exports and imports show markedly increased values in nearly all sections of the table.

The exports reached the respectable total of £499,384, as compared with £353,266 in April; the imports were valued at £302,583, as against £256,099 in the previous month; while the re-exports were considerably in advance of the April figures.

The increased value of the exports was due principally to improved business in the machinery and cable sections, cable exports showing an increase of £57,000, and machinery £46,000; arc lamp parts and carbons were the only sections to show a reduction as compared with April.

The imports reached the highest recorded total this year, the machinery, cable, goods, and telephonic and telegraphic sections showing increased values.

The re-exports reached £20,889, as compared with £15,391 for the previous month.

India, New South Wales, Russia, and France were our best customers during the month, and to Victoria, Argentina, New Zealand, and Holland also we supplied considerable quantities of material.

The total value of electrical material received from the United States of America during the month showed an advance of £43,000 on the April figures.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,077	12,657	13	1,140	193	1,692	21,650	60	89	24	439	1,121	41,155
Netherlands, Java and Dutch Indies ...	1,079	10,822	1,727	...	...	155	1,331	...	1,076	54	8,105	1,197	25,546
Belgian Congo	...	...	...	...	...	...	...	...	27	...	369	4,590	4,986
France	3,983	2,744	778	160	55	142	14,221	10,355	871	492	18,458	9,020	61,279
Portugal	50	1,665	...	12	...	59	44	80	13	...	440	30	2,393
Spain, Canary Isles and Spanish N. Africa...	27	44	52	...	...	759	2,281	...	64	57	19	172	3,475
Switzerland, Italy and Austria-Hungary ...	242	286	506	...	...	530	3,729	...	...	25	79	3,905	9,302
Greece, Roumania, Turkey and Bulgaria ...	3	275	124	20	...	...	116	...	...	...	...	...	538
Channel Isles, Gibraltar, Malta and Cyprus...	112	230	97	175	...	13	25	53	13	25	30	10,504	11,277
U.S.A., Philippines and Cuba	692	19	193	...	...	864	197	229	20	...	...	298	2,512
Canada and Newfoundland	637	...	40	510	...	172	1,666	55	180	...	...	66	3,326
British West Indies and British Guiana ...	249	...	23	139	38	...	12	14	34	...	...	18	527
Mexico and Central America	29	207	...	...	...	320	183	...	...	...	100	10	849
Peru and Uruguay	249	195	...	...	...	173	214	...	124	...	78	4	1,037
Chile	466	219	62	...	58	10	1,368	239	237	11	105	285	3,060
Brazil	131	540	40	132	...	...	2,103	247	28	125	...	47	3,393
Argentina	2,752	10,836	279	1,561	43	525	1,948	1,399	1,390	13	1,464	518	22,728
Colombia, Venezuela Ecuador and Bolivia...	108	65	11	12	...	225	33	...	12	5	...	169	640
Egypt, Tunis and Morocco	310	1,037	115	502	...	37	1,146	117	643	120	127	8,259	12,413
British West Africa	12	10	...	14	...	16	60	...	...	66	...	40	218
Rhodesia, O.R.C. and Transvaal	1,423	10,085	276	858	...	643	1,357	29	872	...	21	...	15,564
Cape of Good Hope	121	2,194	1,274	1,460	30	267	2,192	117	453	8	148	121	8,385
Natal	469	2,573	594	176	...	398	1,878	...	...	...	14	202	6,304
Zanzibar, Brit. E. Africa, Mauritius & Aden	...	31	...	217	...	48	827	...	35	...	...	...	1,158
Azores, Madeira and Portuguese Africa ...	31	180	5	119	...	...	117	...	15	...	...	37	504
French African Colonies and Madagascar...	...	37	...	...	...	...	107	500	...	...	...	...	644
Persia	47	116	10	82	...	...	10	...	17	...	19	...	301
China and Siam	430	3,376	353	1,194	...	1,746	4,855	156	666	30	221	862	13,889
Japan and Korea	529	...	...	21	...	2,602	...	...	2,815	50	20	476	6,513
India	2,573	23,721	2,832	4,613	547	842	16,748	2,420	6,917	157	1,497	1,054	63,921
Ceylon	117	1,814	155	236	...	182	150	36	185	18	162	121	3,176
Straits Settlements, Fed. Malay States and Sarawak	184	774	584	510	...	41	784	691	144	55	674	324	4,765
Hong Kong	352	379	260	404	...	393	471	...	104	...	144	111	2,618
West Australia	483	3,452	99	502	12	791	3,281	282	136	...	143	...	9,181
South Australia	345	1,966	165	360	...	...	695	...	...	...	626	...	4,157
Victoria	5,382	20,866	2,855	1,232	65	487	13,155	238	1,212	167	950	823	47,432
New South Wales	1,853	20,530	442	1,994	295	1,524	8,016	11,245	4,201	295	12,348	919	63,662
Queensland	149	5,420	112	243	...	...	2,825	...	4,983	...	20	229	13,981
Tasmania	18	3,200	11	81	...	...	22	...	17	...	...	...	3,349
New Zealand and Fiji Islands	442	6,550	384	908	23	1,455	3,880	1,744	1,238	...	2,324	278	19,226
Total, £	28,156	149,115	14,471	19,587	1,359	17,111	113,697	30,306	28,831	1,797	49,144	45,810	499,384

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	...	...	447	...	9,691	...	1,825	721	3,257	15,941
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	26	1,195	63	23,328	3,243	16	105	...	37	...	...	28,013
France	1,395	38	352	10	501	1,029	393	200	8,357	2,104	581	14,960
Switzerland	1,571	...	50	92	...	1,532	4,062	...	581	1,259	414	9,561
Italy	979	8,514	...	...	...	...	30	885	...	...	...	10,408
United States	9,641	4,386	451	5,323	2,327	596	14,091	92,754	4,884	12,131	71,455	218,039
Total, £	13,612	14,133	916	28,753	6,518	3,173	28,372	93,839	15,684	16,215	75,707	296,922

Additional imports.—Spain, carbons, £1,202; China, lamp parts, £317; Japan, electrical goods, £20, glow lamps, £354, arc lamps and parts, £2,005, telegraph wires and cables, £15; Channel Islands, machinery, £20; N.S. Wales, goods, £5; Canada, electrical goods, £135, wires and cables, £1,308, glow lamps, £5, machinery, £275.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	1,550	3,995	...	3,255	333	5,118	4,172	...	383	274	1,809	20,889

TOTAL EXPORTS: £499,384 TOTAL RE-EXPORTS: £20,889 TOTAL IMPORTS: £302,583

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

CONTROL GEAR FOR DIRECT-CURRENT MOTORS.

By E. F. BUTLER.

(*Concluded from page* 699.)

In larger sizes, and for heavier work, the contacts on the slate should be reinforced by carbon rollers, to take any arc away from the contacts. A skate on the arm makes contact with these rollers when passing from one segment to another. Such an arm will usually have a square hole in which contact-blocks can slide freely. Adjustment of pressure is effected by means of a suitable spring acting on a short arm pressing on the top of the contact. It is best to have two contact blocks, as they can bed independently, and the block which first makes contact should be of carbon.

Flexible pigtails are often fitted to shunt the current from the tension spring. The fitting of these is often a source of weakness. The usual arrangement is to drill a hole in the carbon, push in a short piece of brass rod, to which the pigtail is fixed, and hope for the best. Owing to unequal expansion, these pieces of brass often work loose and fail to make good contact. Furthermore, when renewing the carbons it is easy to split them in attempting to fit the pigtails. A way of getting over the difficulty is shown in Fig. 3. A

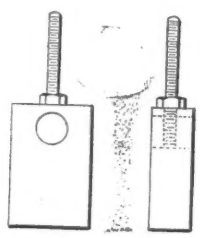

Fig. 3.

hole is drilled through the carbon, and another at right angles into this hole. A piece of round brass is tapped out and inserted. A set-screw is fitted to this, and two nuts at the top serve to hold the pigtail.

In the full-on position a laminated contact on the side of the arm presses against brass pillars on the slate and takes the full-load current. The pressure of this is usually taken against the pull of the no-volt coil, which in a good many cases is not sufficient to make a firm and reliable contact.

The next thing to consider is the resistance. Resistance elements in the form of wire or strip are most common. The construction is usually carried out in such a way that the maximum length of wire is got into as small a space as possible, and the usual form is a spiral, either with or without a core.

When no core is used, it is a good plan to provide separators or distance pieces to prevent the possibility of the coils touching or short-circuiting one another, either from vibration or sagging. This separator may take the form of a substantial sheet of uralite, having holes drilled and spaced correctly, which is slipped over the coils before they are connected up.

Coils wound on a core or former should have plenty of room to expand without buckling; if made of hygroscopic material, earthenware ends should be fitted. It would be an advantage if any coil could be removed independently for renewal or repair. In any case, all the side covers should be easily removable for inspection, and in small and medium sizes the resistances might well be arranged so that they could be removed bodily with the slate.

In order to keep down the sizes and numbers of resistance coils as much as possible, makers sometimes connect a number of coils in parallel to get the required resistance, and while this is often satisfactory, it means extra joints; furthermore, the wires, having a much smaller cross-sectional area, very easily get eaten through in damp locations.

The latest development of resistances in the form of coils is the enamel embedded type, and it seems very likely that these will be very largely used in the future. When properly made they are electrically and mechanically sound. In one form, largely used for Admiralty and dockyard work, a steel tube is covered with a coating of enamel, which will not soften at any ordinary working temperature. The resistance wire is wound over this, and to hold the wire in position a current is passed through it of sufficient strength to soften the enamel; the turns of wire sink in, and are held in place. A second coating of enamel is applied, which serves to preserve the wire from atmospheric influence, and also prevents any surface leakage. Previously to being dipped, suitable tappings are connected in where necessary, and the whole forms a robust self-contained unit. It is impossible to repair a burnt-out coil, but, on the other hand, burnt-out coils are very rare.

The metals available for resistances are somewhat few; iron is very much used, and also the nickel alloys. The latter are characterised by a very low temperature coefficient, which makes them of special value for use in regulating resistances, where it is desirable that a resistance, when once adjusted, shall keep its value permanently.

The most common alloys are nickelin, constantin, manganin, and eureka. Iron is most useful in the form of grids, and when so used, the following points may be noted:—

The formation of rust should be prevented as much as possible, the use of aluminium paint being the most common way.

Only mica insulation should be used; fibre is not uncommon, but very quickly perishes. Grids should be placed vertically, to facilitate cooling. When used on cranes, it will often be found preferable to bolt them up to the roof of the cab. If placed on the floor, which appears to be the usual method, the covers will get dented in, and short-circuit the grids, or there will be trouble due to irregular notching, which will quite likely be found due to the presence of spanners, screw-drivers, and miscellaneous ironmongery in general.

A three-point suspension is useful to prevent sagging, and it may be noted that stamped grids are much stronger and less liable to break than cast ones. An offspring from the grid is the mat or sieve resistance, which, in its usual form, consists of a woven asbestos mat, with the resistance wire threaded backwards and forwards through it. These mats are cheap, and a very fine grading of resistance can be obtained by their use.

The weakest point is in the connection; the mats are usually of very fine wire, and often connected several in parallel, and it seems difficult to make a sound connection to carry the current. This type of resistance has not been found satisfactory for controllers or regulators where it is necessary to keep the resistance continuously in circuit. When so used, the asbestos perishes and the wires short-circuit; furthermore, it is necessary to renew the whole resistance when one portion gives out, as the mats fall to pieces when taking them apart.

Materials of which the resistance decreases when heated up by the passage of the current are not in very general use. Messrs. Reyrolles, Ltd., are probably the leading makers of this type of control gear, and use this class of material to advantage. Its reliability is shown by at least one installation with which the author is familiar. The firm in question is one of the largest colour and poster printers. The starters have been in daily use since 1903, and have given no trouble. The makers of these starters also fit a magnetic blow-out to break the current at the first contact, as did the B.T.H. some years ago, and this seems such a simple and efficacious device that it is a wonder that it is not more widely adopted.

A few more details concerning the ordinary type of starter may be given. The buffer on which the arm rests when in the off position usually consists of a spindle passing through the slate and fixed by a nut, the other end carrying a disk of poor-quality rubber. The most common troubles with this arrangement are the breaking-up of the rubber and the working loose of the spindle in the slate. The usual result in either case is that the arm hits the end of the slot in the cover when the motor is stopped, and gets smashed, or else hits the spindle and knocks a piece out of the slate. It is good practice to use two buffers placed

close together, so that the arm hits them both. Alternatively, a cast socket with lugs, bolted through the slate and using a spring in place of a rubber buffer, can be used. There is a point with regard to the starter arm which is worthy of notice, and that is the design of the end through which the spindle passes. A very common design is shown in fig. 4 at A. This has the fault that a very small

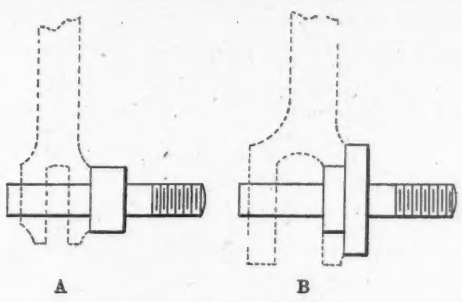

FIG. 4.

amount of wear is sufficient to throw the top end of the arm away from the slate. This often happens to such an extent as to cause sparking and heating of the contacts. A better arrangement is shown at B; the greater length of the spindle, together with the much larger facing and the addition of a shoulder, makes a much more mechanical job, and has a longer life.

The greater part of the foregoing remarks applies, to a very large extent, to starters and regulators used for series motors. In the case of small motors, regulators are often of the plain type, with no automatic features. Of course, this affords no protection to the motor in the event of the failure of the supply, and so it is usual to incorporate some more or less protective devices. In one form, ratchet teeth are cut round the bottom of the starter-arm, and the keeper of the no-volt release is made sufficiently long to engage with them, the end being turned up for the purpose. This arrangement suffers from the defect that the tension of the spring varies with the position of the arm; it is often too strong to hold the arm on the last contacts, and too weak to release when on the first contacts, the trouble being aggravated when the teeth begin to wear. In the most suitable form two arms are used, one acting as a switch, the other as the regulator, the resistance being cut out from right to left. The insulated handle is fixed to the regulator arm, and on moving this hard over, the switch arm is carried on to a contact button, which passes current round the motor, energising a coil which acts both as a no-volt and overload coil, and holds the switch arm on. The backward movement of the regulator arm cuts out the resistances, and so increases the speed of the motor. A somewhat similar arrangement can be used for varying the speed of a shunt motor by altering the strength of the field. In this case the insulated handle is fixed to the regulator arm. When this arm is moved, it pushes in front of it the arm which cuts out the armature resistance and runs the motor up to speed, the shunt resistance being short-circuited until the last stop is reached. The regulator arm can then be moved backwards, and the resistance inserted in the field in so doing. When the current is interrupted, both arms are returned to the off position and the shunt resistance is short-circuited.

A very common fault, and one which has done much to prejudice electric driving, is the abominable and inexcusable practice of having the starter and shunt regulator independent of each other, thus making it possible to start up the motor with a weakened field. In printing works especially, attempts to "inch" under such conditions have been, and still are, a source of trouble. Whenever shunt regulation is desired, it should be made impossible to start up except on a full field. This can be accomplished by means of the double-arm starter just described; or, if a separate regulator is desired, as in the case of an existing starter, or of some type of push-button control, then an electrically-interlocked regulator should be provided. A simple and reliable interlock (Igranic Co.) is shown in fig. 5. It will be seen that the essential part consists of a small coil C, similar to a no-volt coil, connected in series with the shunt fields, having a soft-iron keeper K, and a pair of contacts, A B.

Assuming that the motor were stopped by simply opening the double-pole switch, then the spring S would pull the keeper away from the iron cheeks, and so short-circuit the shunt resistance. The spring is strong enough to prevent the keeper from being attracted, but not strong enough to pull it away once it is attracted. When the motor is started, or re-started, the shunt resistance remains short-circuited until the regulator handle is moved to the "all out" position, pushes the keeper from the face of the magnet, and so unshort-circuits the shunt resistance, and enables it to be inserted in the field circuit.

Although speed regulation by means of resistance inserted in the armature circuit is not much used, as it is wasteful, and the speed varies with the load, it is sometimes convenient. Shunt regulation can be used in addition if required. The connections are as shown in the diagram, fig. 6.

One modification of the ordinary type of starter may be mentioned in passing, and that is the retarded or slow-motion type, which ensures that the resistance is cut out steadily and not too quickly.

The simplest way is to have a starter-arm with teeth cut round the lower end. A small worm-wheel is mounted underneath, free to rock through a short arc, and having a spindle with a crank at one end. The crank is pulled down until the worm engages with the teeth on the starter-arm, and is held down whilst being revolved. When the resistance is all cut out, the crank is released and the worm drops out of gear.

The troubles inseparable from the use of the ordinary type of starter—namely, flashing on the contacts, making

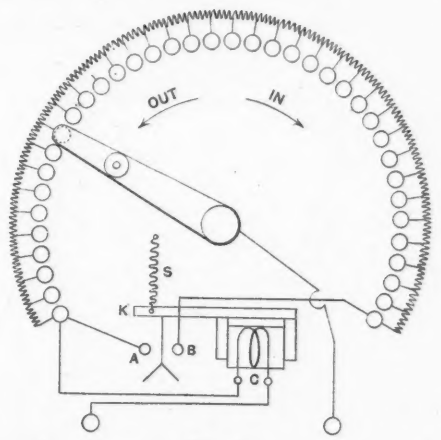

FIG. 5.

and breaking the circuit on the first stud, and the uncertain rate of cutting out the resistance—led makers to try and devise a starter which, without having any great complications, would get over these defects. Some makers are still trying to design a fitting or find out something which will not cost much (this is important), but when added to the ordinary starter will give it interlocking, non-arcing features, automatic acceleration, and dynamic braking. They usually give up the idea, or end by evolving a totally different class of apparatus.

The first step towards the evolution of a better type of control gear followed upon the realisation of the fact that the proper place to make and break a circuit carrying current is at a switch. A starter is not intended to do so, and will not do so. When the starting current of a motor, together with the self-induction of the fields, is to be broken, suitable arrangements must be made to deal with it, namely, auxiliary carbon contacts, operating in an arc-resisting chamber, a magnetic blow-out—in fact, all the essentials of a circuit-breaker, excepting that to avoid excessive pressure rises the break may be arranged to take place more slowly. A piece of apparatus which fills these requirements, and has stood the test of experience, may be described.

Briefly, this type of starter comprises a double-pole breaker which takes the place of switch and fuses, a no-volt and overload release, and a device for preventing too rapid

acceleration. The starter itself looks very much like an ordinary one, but has the addition of a concentric ring on its base.

A contact on the starter-arm consists of a wheel, part of the periphery being an insulator and part metal, which engages with this ring.

On moving the handle forward, this wheel rotates until the brass portion makes contact with the ring, completes the "pull-in" circuit, and closes the double-pole breaker, which consists of two clapper switches. Moving the handle further forward puts an economy resistance in series with the holding-up coils of these switches. If the handle be moved

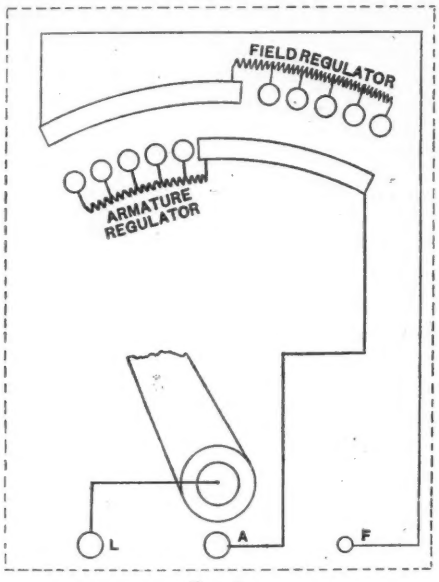

Fig. 6.

over too fast, the overload operates and opens the circuit of the clapper switches, and as the economy resistances are still in circuit, there is not enough current passing to pull them in again and so the handle must be put back to the "off" position.

If the handle be moved backwards while starting up, the roller turns round slightly and the insulating portion touches the brass quadrant; again, the clapper switches open and the arm must be moved right "off."

This type of apparatus also has the advantage that push-buttons can be connected up in series and operate by breaking the "hold-up" circuit. This makes it of particular value for such purposes as printing works and saw-mills.

Having dealt with a number of types of starters largely from the standpoint of design, this article may be fittingly concluded by a few words, more in sorrow than in anger, to the user and the wiring contractor.

The fixing-up of control gear is often done in a slipshod and unworkmanlike manner, probably more often than not. It is a far too common sight to see the double-pole switch and fuses, starter, and sometimes speed regulator and ammeter, fixed to any convenient part of the wall, which may have to be plugged in four places for each item, with cables festooned from one fitting to another, possibly held together at intervals with tape. Sometimes battens are fixed, and the control gear is screwed on to them, attempts at earthing being made by trying to tighten a stranded cable under a countersunk screwhead without washers. It is much more satisfactory to make a sound job, both mechanically and electrically, by mounting the whole of the control gear on steel bars or channels. These should be spaced to take the widest fitting, usually the starter; the other portions can be mounted on ironwork carried across between the uprights, and preferably riveted to them. The whole can be fixed to the wall by means of bolts cemented in, or run in, with lead. To facilitate subsequent repairs, it is advisable to crank the ends of the uprights, or to pack them out from the wall, so that it is possible to work behind the panel.

IRON CONDUCTORS FOR HOUSE WIRING.

A contributor to the *Elektrotechnische Zeitschrift*, obviously desirous of making a virtue of necessity, has drawn up what is probably the best case possible for iron as a house-wiring material. The author states that after overcoming his initial natural prejudice against iron wiring, he realised speedily its numerous advantages, and is now prepared to recommend its use after, as well as during, the war (!). His premises and conclusions are certainly worth consideration, since the exhaustion of the world's copper supplies is due at a much earlier date than the exhaustion of its coalfields. From the notes and examples given below, it will be clear that iron as a house-wiring material is a much more feasible proposition than the use of that metal for transmission and distribution cables and for the windings of electrical machinery.

When there was no more efficient filament lamp than the carbon type, and when electric lighting was a luxury accessible only to the rich, so that the problem was to supply large installations of inefficient lamps, the use of copper as a wiring material was practically essential, and relatively enormous sections of even that good conductor were frequently required. Now, however, the use of tungsten lamps is universal, and there are thousands of small lighting installations having only a few metal-filament lamps supplied through copper wiring, which is rarely worked at anywhere near the permissible voltage drop. For example, the I.E.E. rules specify that the minimum cross-section of any house-wiring conductor (except fittings wires), must be not less than that of an 18 S.W.G. conductor. Such a conductor, rubber insulated, may be worked at 7·2 amperes so far as concerns heating. Taking an average lighting load of 350 watts for a suburban villa, this corresponds to 1·75 amperes at 200 volts, and assuming the whole load to be concentrated at the end of a single pair of leads (which it is not), the length of run might be about 105 yards for a pressure drop of 5 volts (2 per cent. plus 1 volt, as allowed by I.E.E. Rule 40). In other words, the smallest permissible size of copper conductor is unnecessarily large, both from the standpoint of conductivity and temperature rise, in such an installation, and there is a *prima facie* case for a wiring material of lower conductivity.

The permissible voltage drop in house lighting installations being 2 per cent., plus a constant allowance of 1 volt (*i.e.*, 3 per cent. total in 100 volts, and 2½ per cent. in 200-volt circuits), the C.P. variation in metal-filament lamps is about 10 per cent., as against 15 per cent. in carbon-filament lamps, and it must be remembered that the actual voltage drop is very rarely the maximum possible, and then only for the lamps at the far end of the circuit; further, the full 10 per cent. change in C.P. will only occur if all intervening lamps be switched on, and then off. Usually only 15 to 30 per cent., and rarely 50 per cent., of the lamps in a private house are in use at any one time, so that the maximum pressure drop is very rarely more than half the possible value, and the variations in pressure are yet smaller. Arguing on these lines, a number of German electricity supply stations which took 1·5 per cent. voltage drop as the basis for designing house-wiring installations prior to the war have decided to allow 5 to 6 per cent. maximum drop in future.

In order to see what can be done with iron wiring on this basis, let us assume conductors of 1½ and 2½ sq. mm. section (approximately Nos. 17 and 15 S.W.G. respectively) supplying, say, five, and ten, 30-watt lamps (in turn) grouped at the end of a single pair of leads. The length of run of these leads, corresponding to 5 per cent. voltage drop at the terminals of the lamps, will give a very fair indication of the utility or otherwise of iron conductors of the above sizes. Taking the specific resistance of iron as 0·143 ohm per metre per sq. mm., the results may be thus tabulated:—

Supply pressure		110 volts.		220 volts.	
No. of 30-w. lamps		5	10	5	10
Permissible run (single length) of circuit for 5% pressure drop; using iron wires.	Lamps grouped:	Yd.	Yd.	Yd.	Yd.
	17 S.W.G. wire	23	11½	92	46
	15 S.W.G. wire	38½	19	154	77
	Circuit branched:				
	17 S.W.G. wire	35	17½	139	69
	15 S.W.G. wire	58	29	232	116

The two lower lines in this table show the probable run permissible in the same cases as before, but assuming the circuit to be branched, as is invariably the case in actual house-wiring. The exact increase in run permitted by this branching depends on the distribution of the lamps, but it is safe to assume that the most distant lamp may be 1½ times as far from the service point as when all the lamps are supposed grouped at the end of two wires.

There are many thousands of small lighting consumers having, say, eight 30-watt lamps, or their equivalent, installed, and it is obvious from the above table that No. 16 S.W.G. iron wiring could be used in such cases without any fear concerning voltage drop, the effective length of the branch circuits in such houses being less (generally much less) than corresponds to the 5 per cent. maximum pressure drop held to be permissible. By using larger iron conductors (say, up to 7/16 S.W.G.), and by using copper or zinc for the heavily loaded portions of more extensive wiring installations, the possibilities of economy in wiring are greatly extended. An immense amount of copper at present used only for mechanical reasons would be saved. Electrolytic troubles at the junction of dissimilar conductors could be avoided by the use of suitable junction-boxes, and the prevention of rusting on the exposed portions of iron wiring at connecting points does not appear to offer insuperable difficulties, so far as concerns ordinary house wiring. German reports concerning the ease of installing iron wiring are not very favourable, but, on the other hand, it is pointed out that practically no skilled labour is available for the work; and, further, that installation would be much facilitated were rubber-insulated wires available, so that the conductors could be drawn into conduit—but rubber is as scarce as copper in Germany! There seems good ground for the belief that German manufacturers will continue to use iron as a substitute for copper in many electrical applications after the war, and it certainly seems that house wiring is not merely one of the least objectionable of these applications, but one which is distinctly worth closer investigation, even by those to whom the copper markets of the world are still open.

A NEW RÖNTGEN RAY TUBE.

At a recent meeting of the Dresden Electrotechnical Association, Prof. F. J. Koch discussed the latest developments in X-ray equipment, and described a new tube construction due to Lilienfeld. According to Koch, the inconstancy of vacuum in a Röntgen tube operating on a high-pressure rectifier may be attributed to sudden fall in the potential of the electrodes, after attaining the potential difference required to break down the initial resistance of the tube, permitting energy stored in the capacity of the starting-transformer windings to set up oscillatory discharges through the tube. The vacuum is also affected by release of occluded gas on the one hand and by consumption of residual gases in the tube on the other hand. The higher the vacuum the "harder" the tube, but once a steady state has been attained, a skilled operator can maintain practically constant "hardness" for a long time by choosing a suitable current strength.

Lilienfeld has discovered that the nature of the discharge is independent of degree of vacuum, up to a certain point, if an incandescent cathode be employed in the vacuum tube. This principle is applied in the Coolidge tube by using a glowing tungsten spiral as cathode; diffuse cathode rays are sent off in all directions, and generate Röntgen rays where they impinge. The efficiency of the tube decreases rapidly with load, so that control of effect is not easy. With a view to overcoming this difficulty, Lilienfeld adds to the ordinary Röntgen ray tube a special ignition tube containing an incandescent cathode in the shape of an ordinary metal lamp filament. The main and ignition tubes may be excited by two tranformers working in phase, or a single transformer (T, fig. 1), may be used for both purposes. In fig. 1, G represents the incandescent cathode, K the main cathode, and A the anticathode. A variable high resistance R is shunted between K and A, and adds considerably to the homogeneity of the rays. The cathode G is made incandescent by an auxiliary transformer H, and when T develops the breakdown pressure, ignition current flows between G and K. The latter being tubular, cathode rays pass into the Röntgen tube itself, break down its high cathode resistance, and establish discharge between K and A. As compared with R, the internal resistance of the tube is so small that most of the current passes through it, and only a small part through the high-pressure resistance.

As regards general construction, the anticathode is water-cooled, and since the glass shows no fluorescence (electrons being produced artificially), a fluorescent screen is mounted inside the tube to indicate its working. It is claimed that this tube gives constant radiation at all loads, that the hardness or penetrating power of the rays can be varied easily and accurately either by altering the ignition current or by varying the setting of R, and the hardest or softest rays can be obtained at a moment's notice (irrespective of previous conditions) and maintained indefinitely in greater intensity than is possible with other tubes. The quantity of rays varies directly with the current strength, and the radiation is relatively homogeneous. Since no reflected cathode rays fall on the glass, the latter does not become hot in working; also no guard screen is necessary on account of Röntgen-rays from the glass. Sharp negatives are obtained; and the life of the tube is practically equal to that of an

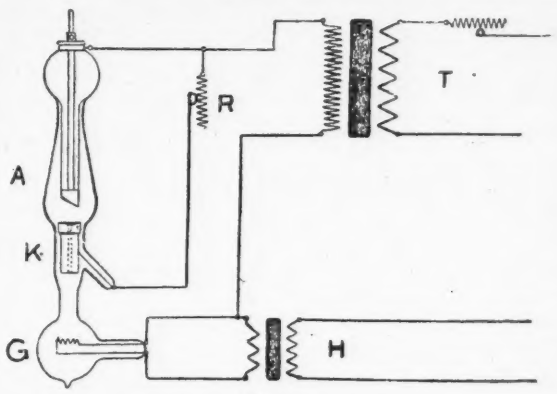

Fig. 1.

ordinary glow lamp (so long as the anticathode is not prematurely damaged by overload), *i.e.*, the life is determined by the incandescent cathode instead of by consumption of residual gas by the cathode rays. The new tube is made with as high a vacuum as possible.

A valve-tube with incandescent cathode is claimed to give excellent results, and to render unnecessary rectification of the high-pressure transformer current. In order to keep the field stress in the spark transformer approximately symmetrical, Koch places a "directional resistance" (porcelain-sheathed aluminium rod in electrolyte contained by an iron vessel), in parallel with the transformer primary.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NETHERLANDS.—In virtue of a Ministerial Resolution dated April 27th, iron moulds used for the construction of concrete ducts for electric cables are classed as machinery in the Dutch Customs Tariff, and will be admitted free of import duty.

MEXICO.—The Board of Trade have received information to the effect that, in virtue of a Mexican Decree published on May 24th, the fee to be charged by Mexican Consular officers for the certification of invoices of goods shipped to Mexico has been fixed at 3 per cent. of the value of the goods covered by the invoice. It is understood that this new rate was to come into force on June 15th as regards shipments from the United States or Cuba, and on July 1st as regards shipments from other countries.

SOUTH AFRICA.—According to a decision, dated April 17th, by the Commissioner of Customs, incandescent bulbs for pocket electric torches are dutiable under No. 114 (b) of the Union Tariff at the rate of 3 per cent. under the General Tariff, with a rebate of 3 per cent. on goods manufactured in the United Kingdom or reciprocating British Colonies.

ITALY.—A Decree, dated May 21st, has been issued by the Lieutenant-General authorising the competent Italian Ministries to prohibit, during the period of the war, the importation into Italy of bulky goods and articles of luxury. The Decree came into force on June 4th.

UNITED STATES—HAYTI.—Ratifications were exchanged on May 3rd of a Treaty which was signed in September last between the United States and Hayti, having for its objects, *inter alia*, the remedying of the present condition of the revenues and finances of Hayti and the carrying out of plans for its economic development and prosperity. The Treaty is to remain in force for 10 years from May 3rd, 1916. It provides for the appointment, upon nomination by the President of the United States, of a General Receiver to collect, receive, and apply all Customs duties on imports and exports; and, further, that the Customs duties shall not be modified in a manner to reduce the revenues therefrom without a previous agreement with the President of the United States.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

8,278. "Electric incandescent lamps." T. H. Benyon. June 12th.

8,285. "Portable electric lighters for gas." R. W. Sanders. June 12th.

8,291. "Recording and reproducing audible and visual indications." British Thomson-Houston Co. (General Electric Co., U.S.A.). June 12th.

8,303. "Transforming motion into electrical waves and impulses." T. B. Dixon. June 12th. (U.S.A., July 19th, 1915.)

8,305. "Telephone transmitter." S. C. Porter. June 12th. (U.S.A., June 12th, 1915.)

8,310. "Electric meters or relays." British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric & Manufacturing Co.). June 12th.

8,320. "Electrical regulators, or rheostats." E. D. Rodway and Switchgear & Cowans, Ltd. June 13th.

8,321. "Holders for electric lamps." W. Trentham. June 13th.

8,334. "Electric detonators or fuses." F. S. Dennison. June 13th.

8,359. "Electric arc lamps." British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co.). June 13th.

8,360. "Control systems for electric motors." British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co.). June 13th.

8,393. "Electrolytic cells." H. C. Jenkins, H. F. Pattinson & R. Wellesley. June 14th.

8,394. "Electrical keyboard transmitting apparatus." H. K. Harris. June 14th.

8,416. "Electrical resistances." H. Snowdon. June 14th.

8,422. "Cutting-out fluid wave transmission lines." G. Constantinesco and W. Haddon. June 14th.

8,430. "Field magnets for magnetos, &c." H. B. Stocks. June 15th.

8,433. "Electric heaters." Cable Accessories Co. & F. H. Reeves. June 15th.

8,436. "Ammeters and voltmeters." V. Deebecque & Walsall Electric Co. June 15th.

8,453. "Glass-working machines." British Thomson-Houston Co. (General Electric Co.). June 15th.

8,457. "Magneto electric machines." A. E. Bennett. June 15th.

8,458. "Electrical make-and-break devices." A. E. Bennett. June 15th.

8,467. "Attachment for electric torches." J. F. Barr. June 15th.

8,470. "Device for attachment to sparking plugs of petrol, &c., engines for automatically cleaning and cooling sparking points of such plugs." A. E. Lamkin. June 15th.

8,473. "Machine switching telephone exchange systems." L. Polinkowsky & Western Electric Co. June 15th.

8,474. "Electric and steam power-generating systems." J. C. Ruths. June 15th. (Germany, June 14th, 1915.)

8,476. "Electric and steam power-generating systems." J. C. Ruths. June 15th. (Germany, June 14th, 1915.)

8,499. "Electrical turning gear for starting internal-combustion engines." Rolls-Royce, Ltd., & F. H. Royce. June 16th.

8,509. "Secondary electric batteries or accumulators." Chloride Electric Storage Co. & H. Dean. June 16th.

8,521. "Fittings for preventing theft of electric incandescent lamps." J. Harrington. June 16th.

8,533. "Electric furnaces, &c." T. Balmforth & Co. and H. J. Kitchen. June 16th.

8,536. "Electric bell actuated by sound waves." T. W. A. Comben. June 17th.

8,550. "Field telephone equipment." A. E. Carr. June 17th.

8,551. "Electric lamps, &c." J. Clegg & J. Cook. June 17th.

8,558. "Variable-rate electricity meters with two counters." Landis and Gyr Soc. Anon. June 17th. (Switzerland, June 22nd, 1915.)

8,574. "Electrical motors." British Thomson-Houston Co. (General Electric Co., U.S.A.). June 17th.

8,581. "Rotary motors actuated by alternating fluid currents." G. Constantinesco & W. Haddon. June 17th.

8,584. "Ignition dynamos." C. T. Mason. June 17th. (U.S.A., June 19th, 1915.)

PUBLISHED SPECIFICATIONS.

1914.

4,808. Sparking Plugs, and the manufacture of same. Thomas Crosbee and Sons, Ltd., & W. J. Spicer. March 29th. (Cognate applications, 11,123/15 and 12,240/15.)

6,197. Controlling Mechanism for Automobiles. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 26th.

6,340. Electric Resistance Regulating Arrangements. J. H. Woolliscroft. April 28th.

7,909. Battery Cases for Electric Cycle Lamps. F. Westwood. May 28th.

8,004. Insulating Material and Method of producing same. H. B. MacFarland & R. J. Shoemaker. May 29th.

8,106. Protective Arrangements for Alternating-current Apparatus. F. E. Berry. June 1st.

8,305. Method of and means for Separating Metals by Electrolysis. A. Walker. June 4th.

8,318. Mechanism for Operating Electrically-worked Tramway and Railway Track Points. J. Murray. June 4th.

8,327. Composite Metal Bodies. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 4th.

8,417. Casing for the Stators of Dynamo-electrical Machines. Maschinenfabrik Oerlikon. June 7th. (June 30th, 1914).

9,408. Cases for Ammeters and Voltmeters. A. Chinn & H. Butler. June 28th.

11,224. Magnetos Applicable for the Lighting of Vehicles. J. Bethenod. August 3rd. (June 27th, 1914.)

11,473. Alternating-current Motors. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 9th.

11,684. Controlling Mechanism for Printing Presses operated by Electric Motors. Goss Printing Press Co., of England (Goss Printing Press Co.). August 12th.

12,702. Electrical Heating Elements. H. Cheshire (trading as Cranmer and Cheshire). September 4th.

12,772. Electrical Switches. A. C. Wynne. September 7th.

14,164. Electric Resistances. J. Collinson. October 6th.

14,273. Process for the Electrolysis and Treatment of Sulphate Liquors. E. J. Hunt & W. T. Gidden. October 8th. (Addition to 11,634/13.)

14,499. Guards for the Cords or Wires of Telephone Sets. O. Yates, Sen., H. Gambling & L. F. Parker. October 13th.

15,563. Construction of Electric Switch. G. Markt. November 4th.

16,452. Electric Soldering Irons. J. G. Clemens. November 22nd. (November 21st, 1914.)

1916.

801. Shadeholders for Gas or Electric Light Fittings. R. W. McLachlan. January 18th, 1916. Patent No. 100,525.

955. Electric Condensers. H. R. van Deventer. February 15th, 1915. (Patent No. 100,081.)

3,389. Alternating-current Electromagnets. Waygood-Otis, Ltd. (Otis Elevator Co.). March 7th, 1916. Patent No. 100,519.

3,533. Multiple-contact Microphones. Signal Ges. January 19th, 1915. Patent No. 100,156.

3,658. Starting Mechanism for Internal-combustion Engines. British Westinghouse Electric & Manufacturing Co. April 6th, 1915. Patent No. 100,246.

3,659. Starting Mechanisms for Internal-combustion Engines. British Westinghouse Electric & Manufacturing Co. March 24th, 1915. Patent No. 100,197.

4,109. Joint for an Electric Cable. A. E. Tanner & E. A. Claremont. March 20th, 1916. (Addition to 6,980/15.) Patent No. 100,511.

LIST OF BRITISH PATENTS EXPIRING DURING 1916.

(*Continued from page 720.*)

9,488. April 24th, 1902. A. W. Beuttell. Electric lamps.

9,803. April 28th, 1902. M. Wildermann. Electrolysis.

10,181. May 2nd, 1902. O. J. Lodge & A. Muirhead. Syntonic telegraphy.

10,204. May 3rd, 1902. J. Hargreaves, J. W. Stubbs & J. Kearsley. Electrolysis.

10,452. May 6th, 1902. J. E. Evans-Jackson. Wireless telegraphy.

11,085. May 14th, 1902. Stothert & Pitt and E. Evans. Electric cranes.

11,500. May 20th, 1902. G. C. Marks. Electric switches.

11,698. May 22nd, 1902. W. D. Kilroy. Time indicators for stokers, &c.

12,159. May 28th, 1902. C. D. Abel. Electric lamps.

12,554. June 2nd, 1902. Siemens Bros. & Co. Telephone systems.

12,706. June 3rd, 1902. C. D. Ehret. Electric telegraphs.

13,287. June 11th, 1902. H. H. Lake. Signals, marine; locating sounds.

13,521. June 14th, 1902. Sir O. J. Lodge, A. Muirhead & E. E. Robinson. Wireless telegraphy.

14,133. June 21st, 1902. H. Baker & Castner-Kellner Alkali Co. Electrodes; couplings.

14,135. June 21st, 1902. H. Baker & A. T. Smith and Castner-Kellner Alkali Co. Electrolysis.

14,136. June 21st, 1902. W. A. Gorman & A. Graham. Telephones for divers, &c.

14,228. June 23rd, 1902. W. Schuster. Clutches.

14,269. June 24th, 1902. E. W. Smith. Controlling traffic on railways.

14,286. June 24th, 1902. T. A. Hearson. Electric vehicles.

14,308. June 24th, 1902. J. P. O'Donnell & E. C. Irving. Railway signals.

14,373. June 25th, 1902. Lancashire Dynamo & Motor Co. and R. S. McLeod. Electric distribution.

14,430. June 25th, 1902. F. H. W. Higgins. Telegraphs; gearing.

14,732. July 2nd, 1902. T. B. Murray & N. O. Fulton. Magneto-electric machines; dynamos.

14,774. July 2nd, 1902. Vickers, Sons & Maxim, A. D. Williamson and C. L. Sumpter. Electric motors; planing machines, &c.

14,790. July 2nd, 1902. Johnson-Lundell Electric Traction Co. Dynamo-electric machines.

14,851. July 3rd, 1902. L. Lohner & F. Porsche. Dynamos and motors, controlling; systems of electric lighting.

15,095. July 7th, 1902. F. Conrad. Electric testing.

16,034. July 18th, 1902. G. S. Baker. Toothed gearing.

16,041. July 18th, 1902. A. C. Reyrolle. Electric resistances and heaters.

16,495. July 24th, 1902. J. E. Bousfield. Welding chain links.

16,529. July 25th, 1902. M. I. Pupin. Telephone and telegraph cables and conductors.

16,923. July 30th, 1902. H. H. Lake. Incandescent electric lamps; moulding glass.

17,406. August 7th, 1902. A. Blondel. Electric lamps.

17,703. August 12th, 1902. R. A. Fessenden. Wireless signalling, &c.

17,705. August 12th, 1902. R. A. Fessenden. Wireless signalling.

17,706. August 12th, 1902. R. A. Fessenden. Wireless signalling.

17,708. August 12th, 1902. R. A. Fessenden. Wireless signalling.

18,328. August 20th, 1902. British Thomson-Houston Co. Electric switches; motors, controlling.

18,747. August 26th, 1902. R. Haddan. Telephone systems.

18,786.* August 26th, 1902. H. Bremer. Electric lamps.

18,817. August 27th, 1902. British Thomson-Houston Co. Electric motors.

18,821. August 27th, 1902. British Thomson-Houston Co. Electric motors.

(*To be concluded.*)

A Fire Without a Flame.—The strangest freak fire in the history of the Dayton fire department occurred recently at the Paris Store. An electric iron left on a table burned its way through the table, through the flooring, through a 10-in. joist that supported the floor, and was dangling by its wires from the ceiling of the storeroom below when discovered. The fire department investigated, but did not throw any water, for the iron had not fired the building. The only repairs necessary will be to reinforce the burned joist and close the hole in the ceiling and floor.—*Electrical World.*

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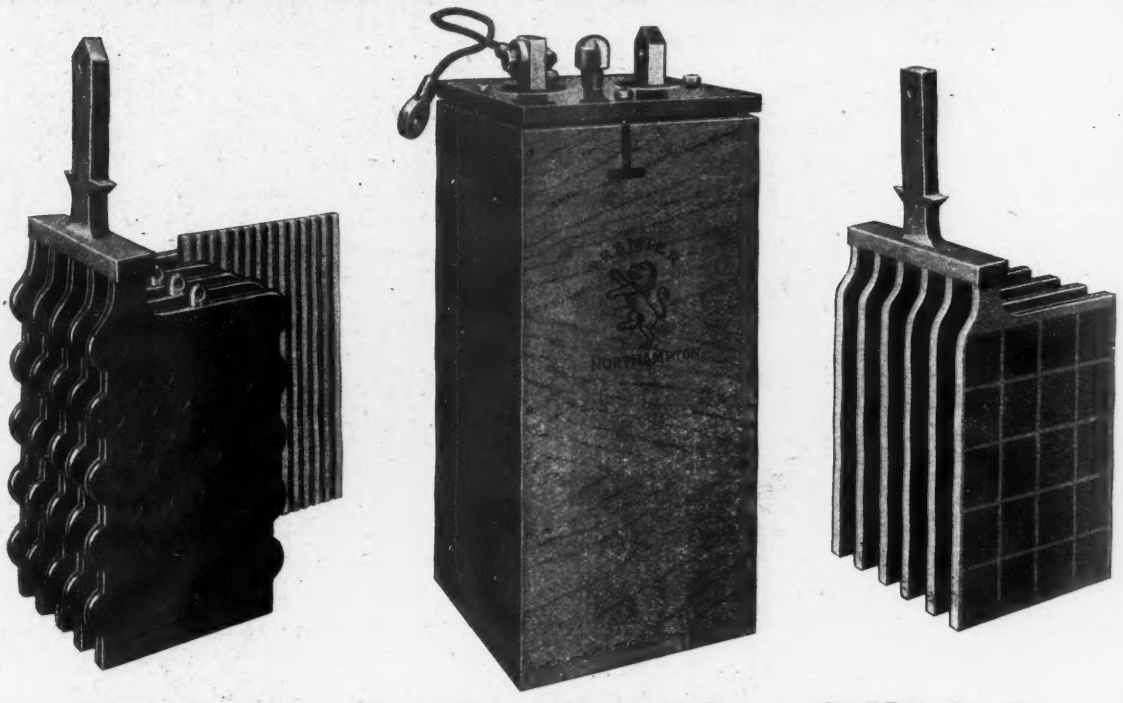

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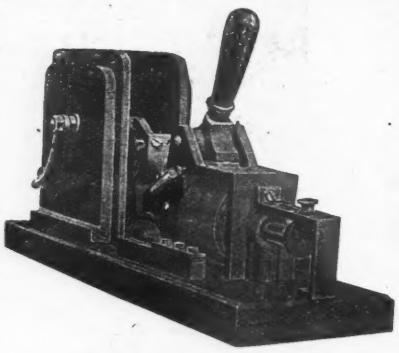

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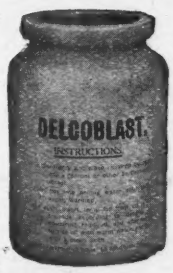

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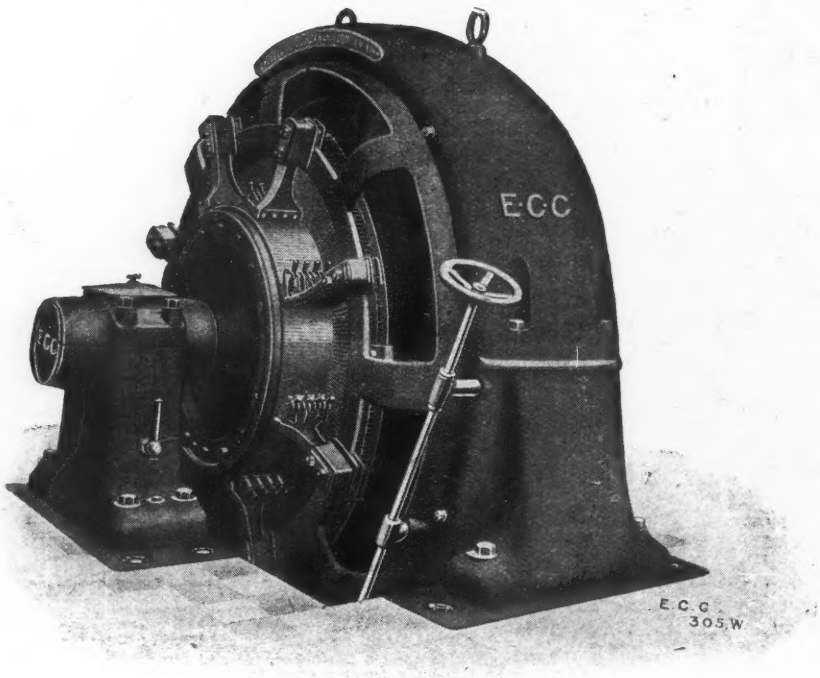

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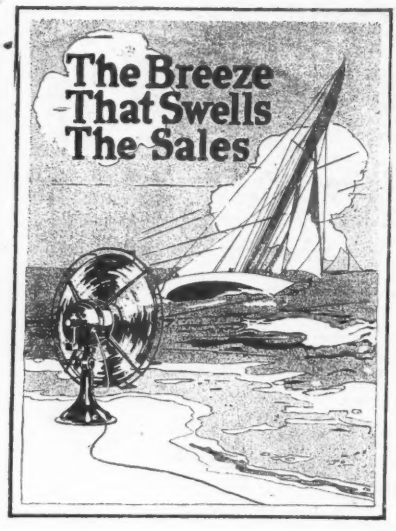

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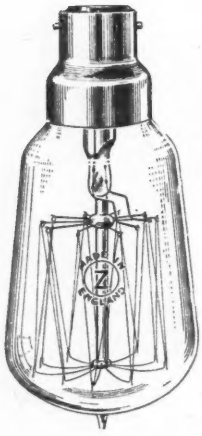

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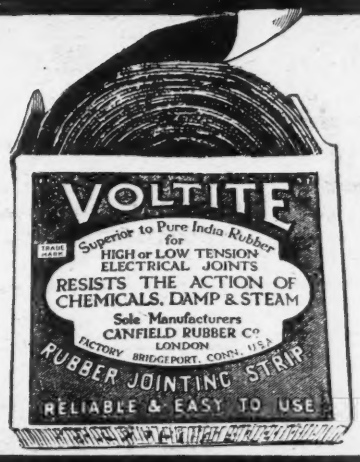
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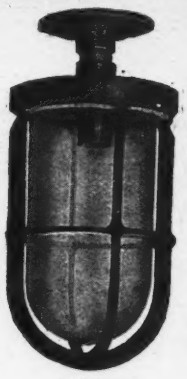

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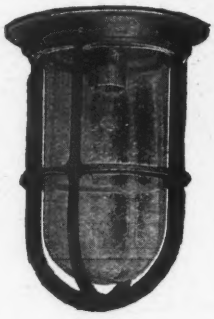

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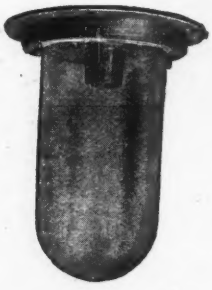

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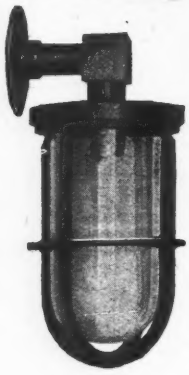

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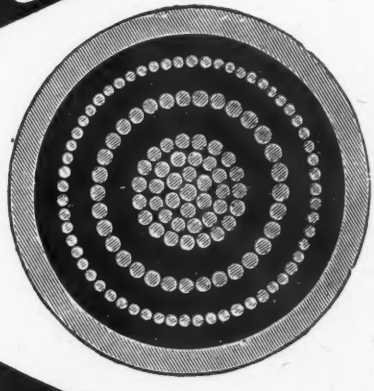

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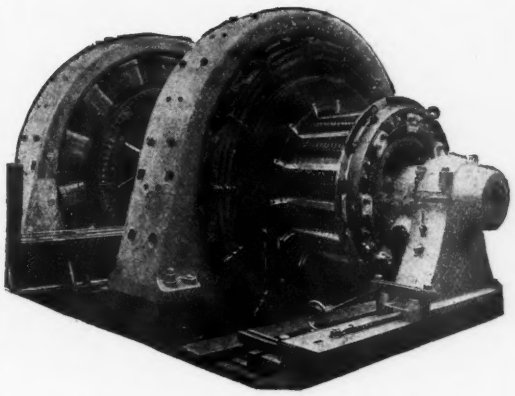

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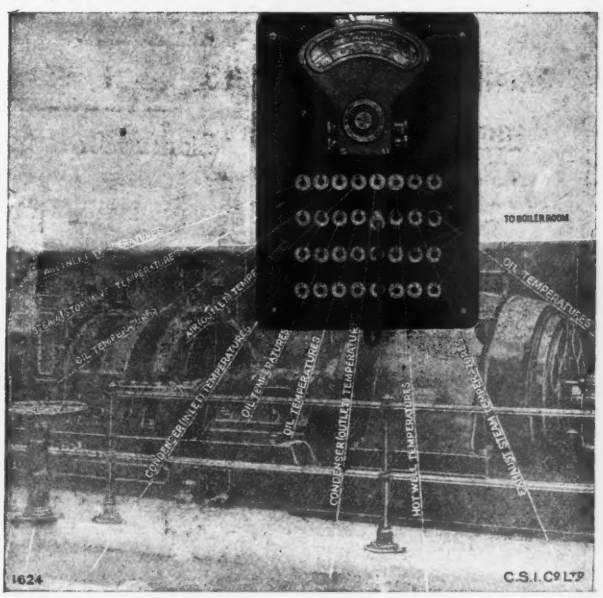

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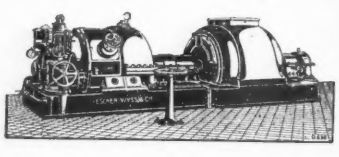

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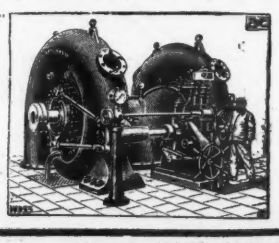

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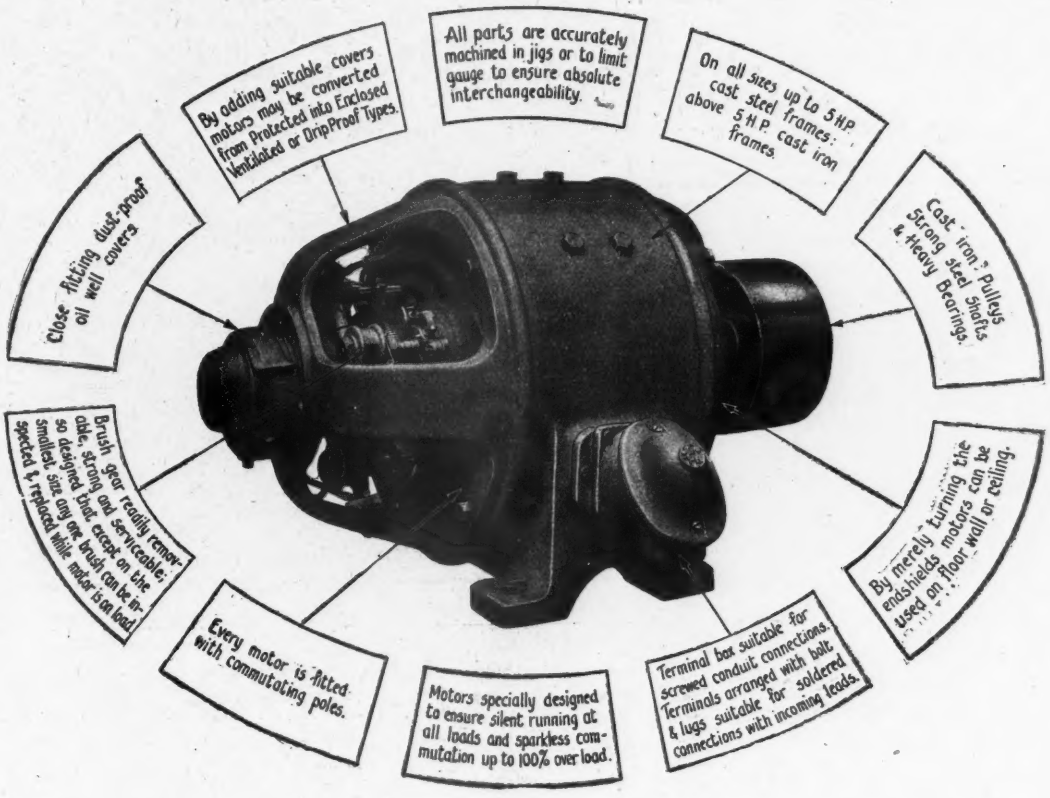
The Electrical Hall Mark—for Quality.

Prominent Features of

B.T.H Direct Current Motors,

Type DR.


All parts are accurately machined in jigs or to limit gauge to ensure absolute interchangeability.
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On all sizes up to 5 H.P. cast steel frames: above 5 H.P. cast iron frames.
Close fitting dust-proof oil well covers
Cast iron Pulleys Strong steel Shafts & Heavy Bearings.
Brush gear readily removable, strong and serviceable: so designed that, except on the smallest size only one brush can be inspected & replaced while motor is on load.
By merely turning the endshields motors can be used on floor wall or ceiling.
Every motor is fitted with Commutating poles.
Motors specially designed to ensure silent running at all loads and sparkless commutation up to 100% over load.
Terminal box suitable for screwed conduit connections. Terminals arranged with bolt & lugs suitable for soldered connections with incoming leads.

All material used in building Type DR Motors is purchased, manufactured, assembled and tested under the most rigid specifications.

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Electrical Engineers should counteract their losses, if any, by using Berry's Patent Foolproof Switchgear, and

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Model 375.

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The resistance of Model 375 Galvanometer is approximately 29 ohms. The current required for a millimetre (1 scale division) deflection is 16 micro-amperes.

With 1 Volt a deflection of 1 millimetre (1 scale division) will be obtained through 62,500 ohms, but as a deflection of 0'2 of a scale division can be readily detected, the Galvanometer is, in reality, serviceable through 302,500 ohms.

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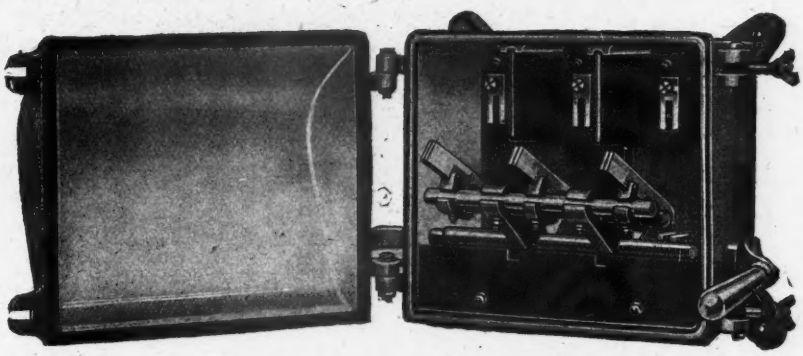

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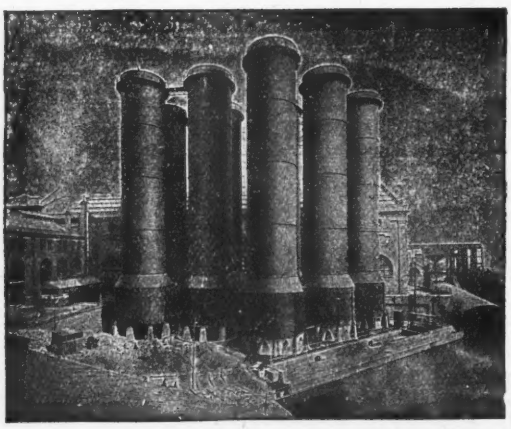

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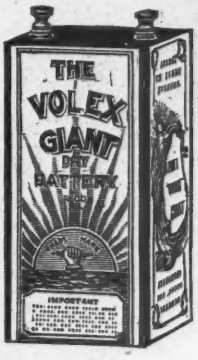

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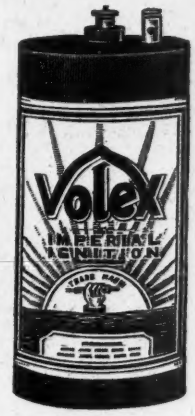

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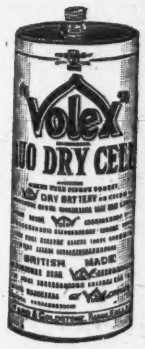

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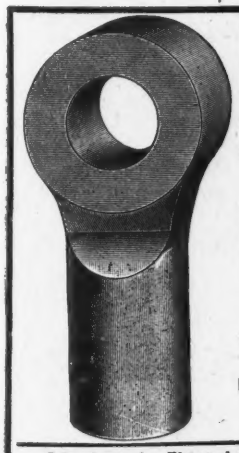

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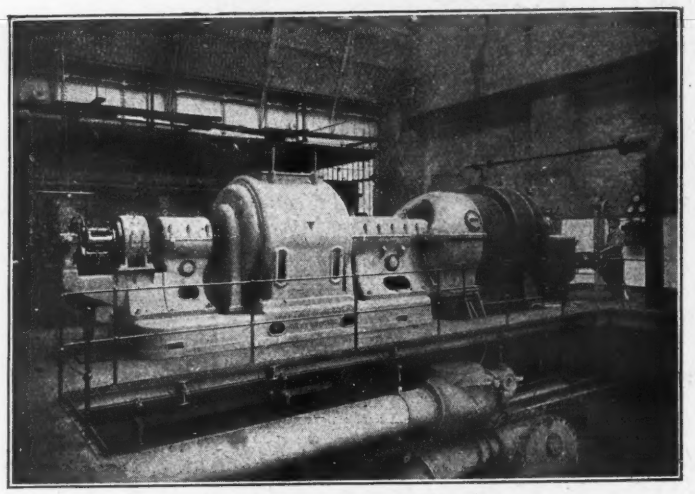

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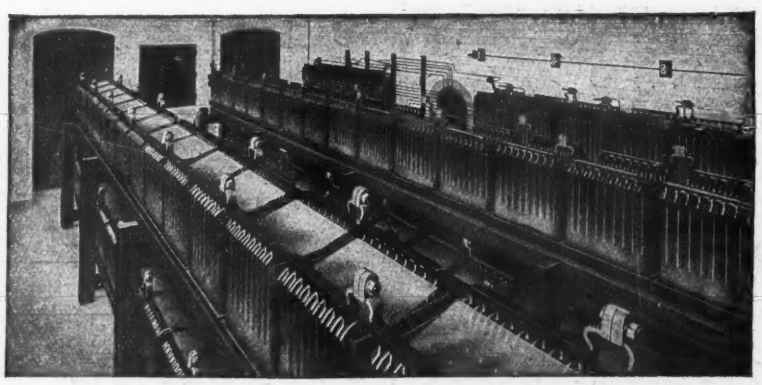

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STORAGE CELLS FOR ALL CLASSES OF ELECTRIC LIGHTING.

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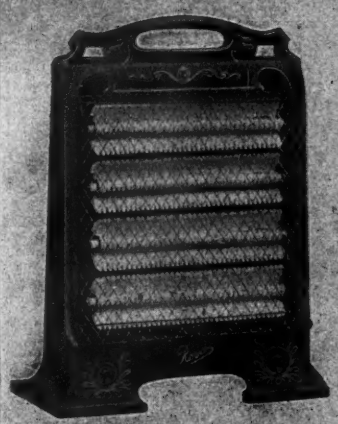

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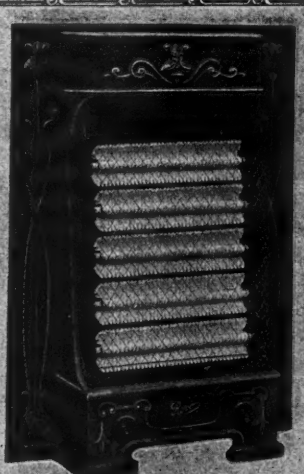

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Instantaneous Heat. No Time Lag.
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"Are you able to continue to supply us with Le Carbone Brushes."

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This affirmative answer has greatly eased the minds of all our customers.

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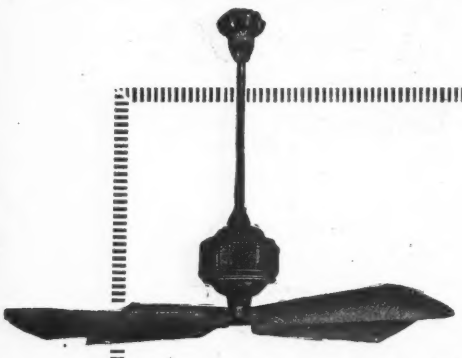

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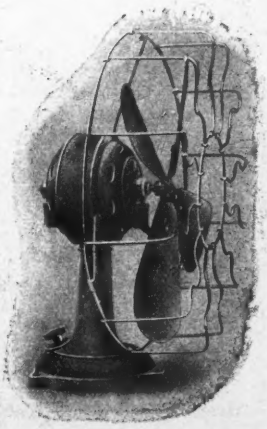

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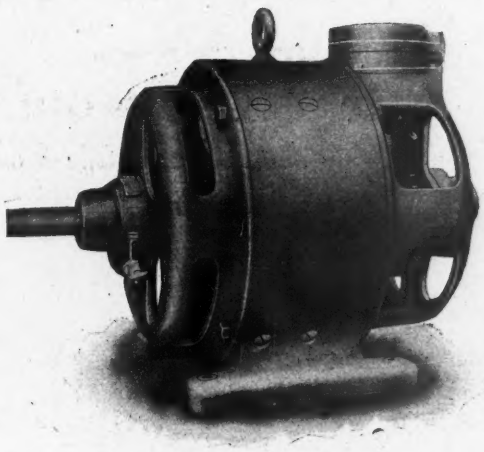

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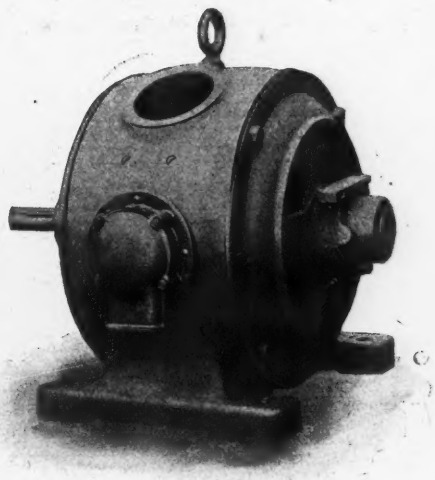

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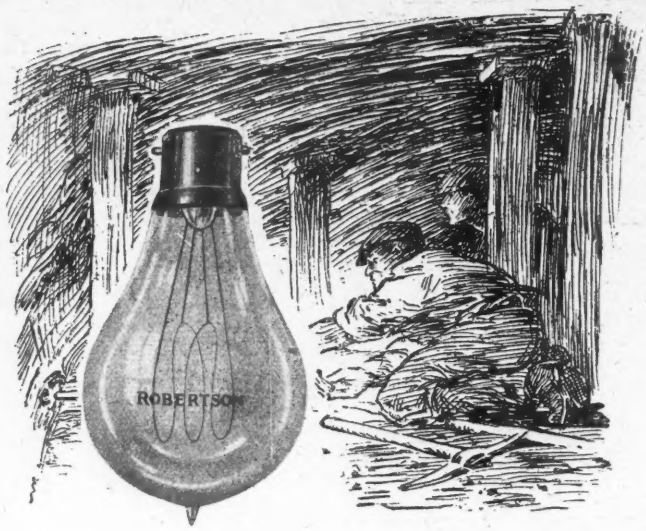

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British Made at the Osram-Robertson Lamp Works, Hammersmith, London.

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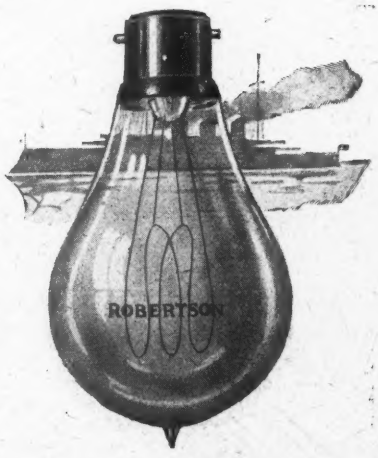

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TO SELL BY PUBLIC AUCTION

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at 12.30 o'clock precisely,

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PRINCIPAL: J. C. M. GARNETT, M.A. (late Fellow of Trinity College, Cambridge).

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Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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A.M.I.E.E., A.M.I.C.E., A.M.I.M.E., Matriculation, B.Sc. (Engineering), secured with minimum expense and energy by "U.E.C." Individualised Correspondence Courses. Advice and guidance *free*. — Apply Advisory Secretary, UNIVERSITY ENGINEERING COLLEGE, 3, St. Mark's Crescent, Regent's Park, London, N.W. (Five advertisements below.) 443

CORRESPONDENCE Courses in Civil, Electrical, and Mechanical Engineering. Specially *Reduced* Fees during the War! Success *guaranteed!* — UNIVERSITY ENGINEERING COLLEGE. (Advertisements above and below.) 444

ELECTRICAL Engineers desiring *early* advancement will be well advised to send for the "U.E.C." Prospectus, see UNIVERSITY ENGINEERING COLLEGE advertisements, numbered 443, 444, 446, 447, 448, *at once!* 445

FREE!! Send *immediately* for "U.E.C." Prospectus of Specialised Engineering, Mathematical and Examination Training. Unique System! Record series of successes.—UNIVERSITY ENGINEERING COLLEGE. (Advertisements above and below.) 446

MATHEMATICS effectively mastered by the "U.E.C." *practical* Correspondence System. The *most profitable investment* on market. *Commercial Engineering*, Works Management, Installations, Electrical Design, Draughtsmanship, &c.; UNIVERSITY ENGINEERING COLLEGE advertisements numbered 443, 444, 445, 446, 448. 447

WANTED Engineers—to fill responsible positions in the Trade Boom ahead! *Think!! Are you qualified?*—Let "U.E.C." particularly advise and quote you *free* concerning Course of Spare-Time Training to most profitably develop *your* abilities.—Write now to UNIVERSITY ENGINEERING COLLEGE. (Five Advertisements above.) 448

SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

JUNIOR ASSISTANT WANTED.

JUNIOR ASSISTANT wanted immediately for D.C. Power Station. Gas and Diesel Engines.

Applicants should have had good technical training and some previous experience.

Salary 30s. per week.

Applications stating age, experience and when duties can be commenced, and accompanied by three recent Testimonials, to be sent to MANAGER, Electricity Works, Leek. 5708

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

WAR DEPARTMENT. ELECTRIC POWER STATIONS.

APPLICATIONS are invited for the following positions in Military Electric Power Stations situated in Yorkshire and Staffordshire :—

District Electrical Engineer.
Station Engineer.
Shift Engineers.
Station Fitters.
Linesman Jointers.

Experience in running steam plant essential. Preference given to engineers ineligible for service and *ex*-Naval or military men. Knowledge of Garrett engines, overhead transmission lines, and deep well pumping will be a recommendation. Applications enclosing copies of testimonials, and stating brief *résumé* of training and wages required, should be addressed to the undersigned and the envelopes endorsed "Power Station Staff."

W. CAMPBELL.
Commanding Royal Engineer,
13, Wenlock Terrace,
York. 5688

RIPON MILITARY CAMP.

Power Station and Distribution Staff.

THE C.R.E., Ripon, is prepared to receive applications for the undermentioned Posts from men ineligible for "General Service" in the Army.

Station Engineer	...	£3	10	0	a week.
Assistant Engineer	...	£2	15	0	do.
Charge Engineer	...	£2	10	0	do.
Station Fitter ...	...	£2	10	0	do.
Linesman Jointer	...	£2	2	0	do.

Single men's quarters free, married quarters at $\frac{1}{10}$th of salary.
Applications to be addressed to :—

C. R. E.
Quintcliffe House,
Ripon. 5726

HOLMFIRTH URBAN DISTRICT COUNCIL.

THE above Council require an Assistant at their Electricity Works ; one with experience of Suction Gas Plant and overhead wiring preferred.

Applications, stating age, experience and wages required, to be received by me not later than noon on WEDNESDAY, the 5th JULY, 1916.

A. PERCY RUSCOE.
Clerk to the Council.

Council Offices,
Holmfirth.
23rd June, 1916. 5732

COUNTY BOROUGH OF NEWPORT.

Electricity Department.

JUNIOR Engineers-in-Charge are urgently required. Must have been employed at least 2 years in a works of not less than 2000 KW. capacity ; experience in running of Steam Plant essential. Wages to commence at £2 5s. per week of 53½ hours ; overtime afterwards at single time during the period of the war. Applications, in candidates' own handwriting, stating age, together with three references, to be sent in at once to the undersigned.

A. NICOLS MOORE.
Borough Electrical and Tramways Engineer.

Town Hall,
Newport, Mon.
June 26th, 1916. 5734

LEEK URBAN DISTRICT COUNCIL.

THE LIGHTING COMMITTEE of the above Council invite applications for the position of Chief Assistant Engineer and Manager of their Electricity Undertaking. Salary, £160 per annum.

Applications, to be sent in, on official form only, with 3 *copies* of recent testimonials, endorsed Assistant Engineer, and addressed to the Chairman of the Lighting Committee, Town Hall, Leek. Applications to be sent in by 10 a.m., July 14th, 1916.

Application forms to be obtained from RD. H. GINMAN, General Manager, Gas and Electricity Offices, Newcastle Road, Leek.

By Order,
HAROLD HENSHAW,
Clerk to the Council. 5754

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ARMATURE Winder ; all-round man, used to A.C. and D.C. ; new and repairs. No man already on Government work need apply.—Call or write PENROSE, Little Saffron Hill, E.C. 477

ASSISTANT Clerk wanted for Electrical Engineers' office ; must be good book-keeper and shorthand typist. Good prospects to energetic man. No one resident more than 10 miles away, or on Government work, need apply.—523, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VAC – *ntinued.*

ASSISTANT required to Engineer in charge of H.T. Electrical Sub-Stations (London District) ; must be ineligible for military service, and have had actual experience with H.V. 3-phase systems and Rotary Converters. Only qualified men who can be released need apply.—5715, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Switchboard Operator, 11,000-volt, three-phase Power Station (London District). Give age and state wages required.—Only men who can be released by present employer need apply.—5735, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer required at a Diesel 3-phase power station near London ; experience with Diesel plant desirable, but not essential. Permanent position to suitable man. War service badge issued.—5745, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHIEF Clerk, &c., required by a London establishment. Applicants must be capable of staff supervision, and must possess tact and initiative. A thorough commercial knowledge is also essential. Applications will not be considered from men engaged on Government work or residing more than 10 miles away.—Write stating full experience, age and salary expected, to 5762, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DIESEL Driver wanted, one experienced in central station works preferred ; state age, wages required. Enclose testimonials to 5709, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINE-Driver (ineligible) required for tramway power station in South Wales, accustomed to high-speed engines, high and low-tension plant. Wages 37s. 6d. for 56-hour week, plus war bonus of 2s.—Applications, enclosing copies of two testimonials, with brief particulars of training and experience, to 5741, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, ineligible, for period of war only, to take charge of small station ; must have knowledge of maintenance of meters, overhead mains, and electrical plant generally.—Apply SECRETARY, Electrical Supply Co., Torpoint, Cornwall. 505

ENGINEER (ineligible for H.M. Forces) to take complete charge for duration of war of private Electric Lighting and Power Plant (two 27-H.P. gas engines, with producers) ; also Water Pumping Plant (oil engine, with 4 pumps, softening apparatus, &c.). System embraces mansion, dairy farm, and part village ; state age, experience, and wages required.—F. L. WYATT, Buckland Estate Office, Faringdon, Berks. 405

EXPERIENCED Draughtsman required by Control Gear Manufacturers in London. Must be ineligible for the Army. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—Apply stating age, salary and experience, to 456, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GLASSBLOWER Foreman (bench work) for shop on war service ; must be used to control. No applications can be considered from individuals already on War work.—Apply, stating experience and wages required, in confidence, to 5382, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GOOD Electrical Draughtsman wanted, used to small Motors, Dynamos and Switchgears.—Only those not already upon Government work need apply, stating age, experience and salary required to nearest BOARD OF TRADE LABOUR EXCHANGE, mentioning this paper and No. 5697.

IMPROVER.—Wanted Youth, with about 2 years' mechanical or electrical experience, to learn central station work. Small station in ideal healthy residential town.—Apply stating age, salary expected and experience, to 5740, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JUNIOR Draughtsman wanted for an electricity supply undertaking.—Apply giving particulars, age and salary required, enclosing copies of not more than three testimonials, to the BURGH ELECTRICAL ENGINEER, Blackhall, Paisley. 5736

JUNIOR Electrical Engineer (ineligible for military service) wanted for private electric plant.—Apply, full particulars, age, experience, wages, &c., SECRETARY, Pryce Jones, Limited, Newtown, Montgomeryshire. 503

REQUIRED by Electrical Manufacturers (London Office) gentleman accustomed to preparation of Engineering catalogues and advertising matter generally. Similar recent experience essential. No one at present engaged on Government work, or residing more than 10 miles from City of London, need apply.—Apply in confidence, stating experience, salary required, &c., 5630, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SEVENOAKS and District Electricity Co., Ltd.—Applications are invited for position as Chief Assistant Engineer ; permanency : H.T., 3-phase and Diesel engines. Good mechanical and electrical training essential ; Diesel engine experience an advantage.—Apply immediately, stating salary expected, age, experience and when duties can be commenced, to CHIEF ENGINEER, Sundridge, Sevenoaks. 5748

SHIFT Engineer wanted for small supply station near London : 3-phase, H.T. Diesel engines.—Apply giving age, experience, salary expected, and date duties could be commenced, to 5749, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

SHIFT Engineers wanted, H.T.A.C. and turbine experience essential. Good mechanical training a recommendation. Wages, £2 5s. per week of seven eight-hour shifts. The company a certified undertaking under the Munitions of War Act. Men over military age preferred.—Apply stating age, full qualifications, &c., and when able to commence, 5746, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHOWROOM Salesman, with knowledge of electrical accessories and fittings; must be ineligible for military service. Large wholesale British house.—State age, experience and salary required, to 515, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SMART Traveller wanted to sell lamps, cables, &c., by well-established firm of electrical engineers, in East Yorkshire district; must be ineligible for military service, and preferably have existing connection.—Applications, stating full particulars of past experience and salary required, in strictest confidence, to 5742, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SUB-Station Attendants and Assistants (London district). Men of each grade required. Charge Attendants must have had experience with rotaries and H.T. three-phase systems. Only men who can be released by present employers need apply. Describe experience fully, and state wages desired.—5678, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant wanted at once, Slade's Green Electric Light and Power Station (three-wire D.G.). Knowledge of battery routine, wiring, and arc lamps necessary. Average 56 hours weekly. State age, experience, and pay required.—P. C. TEMPEST, S.E. & C. Railway, Tonbridge Station. 506

TELEPHONE Fitters and Faultsmen required, used to inter communicating installations, ineligible. — Apply LEEDS PRIVATE TELEPHONE (NEW SYSTEM) CO., LTD., 2, Basinghall Square, Leeds. 5744

TWO Switchboard Attendants with H.T. 3-phase station experience wanted for Government Factory in South of Scotland; salary from 45s. per 63-hour 7-shift week, according to experience. Only unbadged men or men not on war work need apply.—Applications, giving details of experience and enclosing copies of testimonials, to 5730, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, for factory near London, several first-class Draughtsmen, thoroughly accustomed to the design of heavy motor road vehicles (petrol).—Apply stating age, experience and salary required, to nearest LABOUR EXCHANGE, mentioning No. A 1971. Application from men at present employed on Government work will not be entertained. 455

WIREMEN (efficient power, lighting).—Apply personally, at once, LINDOW, 6, Shelburne Road, Holloway. 526

WORKS Foreman, London, capable of taking charge and used to small capstan and press work; state experience and salary required. No person resident more than ten miles away, or engaged on Government work, will be engaged.—5690, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A THOROUGH trained theoretical, practical, experienced electrical and mechanical works rubber Engineer, 32 (ineligible), desires responsible appointment. Tactful and energetic; used to taking initiative and control. Public school education.—480, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN wants evening work; electrical and mechanical; London district.—440, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer (ineligible) desires responsible position; University trained; first class works and commercial experience.—485, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (ineligible, 31), good technical training and engineering experience, desires position of responsibility.—453, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (32, married, two children) on munitions in India. Services available March, 1917. Manufacturing, installing, and running experience in practically all branches of the application of electricity. Last two appointments staff billets. World-wide experience. First-class references. Correspondence invited.—497, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (43), practical mechanic, used to installing power, lighting, &c., throughout, or take charge of installation Home or abroad.—409, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN-Wireman Mechanic desires spare time employment.—483, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIANS (2) want piece-work or contract; all branches.—COWLING, 95, Chatsworth Road, Clapton. 491

SITUATIONS WANTED.—*Continued.*

ENGINEER, just completed large Government contract, is open to Represent Manufacturer of Engineering Plant or Accessories in Lancashire; or would inspect, test, and report on all kinds of electrical plant and material. First-class references.—498, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER (36, exempt), good electrical and mechanical training, desires responsible position.—471, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

EXPERIENCED Electrician requires situation in power station or charge of private plant.—"ELECTRICIAN," 28, Grove Road, Hitchen, Herts. 525

JUNIOR Draughtsman requires situation (ineligible). Qualifications; Motor Engineering, knowledge of French.—PRICE, 17, Maitland Park Villas, Hampstead, N.W. 430

MANAGING Electrical and Mechanical Engineer (42) with good technical and commercial experience seeks position with progressive manufacturing firm.—519, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SPECIALIST, Electrical Cooking and Heating Engineer. 16 years' experience, desires engagement with progressive firm as manager after the war.—469, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WAR Work.—Assistant Works Manager is open to accept similar or other responsible position; experienced practical engineer, mechanical and electrical modern machine-shop methods, energy organisation, output, strict disciplinarian; normal work, small dynamos, motors, &c. (speciality for automobile use). Munition work, shells, fuses, grenades. Age 29. London preferred.—521, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN, competent, case or tube.—B., 38, Stangate Street, London, S.E. 516

WIREMAN'S Mate wants job, used to screwed tube work. Rate 8½d.—V. J. F., 32, Claremont Square, E.C. 511

PARTNERSHIP.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

COMMERCIAL Man wanted as Partner, to join two technical men starting manufacture of electric lighting articles. Very wide field. Part capital to hand.—504, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PARTNER (Sleeping), £250 capital, £100 remain in charge; purpose—placing Mayfield's Telephone Augmenter on market (*vide* REVIEW, June 2). Orders ready for booking. Enormous correspondence big trade house proving sensational interest taken in invention; enormous profits; article required by all. Simple apparatus attached any ordinary 'phone augments inaudible speech to fill large room. Mr. Mayfield provides workshop, pays advertising, printing, and expenses three months. Letters only, interviews appointment, as out daily on munitions. A splendid opportunity is here given for any gentleman with small capital to secure a splendid investment for small capital outlay.—C. MAYFIELD, 31, Red Lion Street, London, W.C. 501

AGENCIES.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A FEW Agencies are open for a British Made M. F. Lamp, with 18 months' guarantee; liberal discount. — THE RADIO ELECTRIC LAMP CO., LTD., 17, Great Chapel Street, London, W. 416

A FIRM of electrical engineers manufacturing polyphase motors and single-phase commutator motors are open to appoint agents in London. — 522, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

LEEK URBAN DISTRICT COUNCIL.

THE Committee of the above Council have now for immediate disposal a 125-KW. Dynamo, suitable for use as a motor. Offers for same to be sent to RD. H. GINMAN, General Manager, Gas and Electricity Offices, Newcastle Road, Leek, by 10 a.m. July 14th, 1916.

By order,
HAROLD HENSHAW,
Clerk to the Council. 5755

(Continued on next page.)

FOR SALE.—*Continued.*

LAMPHOLDERS FOR SALE.

LAMPHOLDERS, immediate delivery from stock. Cordgrip and Shade Carrier Lampholders.

THE MONARCH ELECTRIC CO.,
23, Scarborough Street,
West Hartlepool. 401

FOR SALE.

EIGHT 10-H.P., 500-volt, 400 R.P.M. Westinghouse enclosed Series-Wound Motors, mounted on Iron Bedplate, and fitted with Electric Solenoid Brake at one end and Worm Reduction Gear at other end: complete with Tramway type Controllers and Resistances: all equal to new. Price £75 each.

THE CALEDON ELECTRICAL CO.,
2, Oswald Street, Glasgow. 5738

FOR SALE.

200 and 250-H.P., 500-volt, Slow-Speed, Multipolar Compound Wound, 3-bearing Motors; also 110 and 150-H.P., 220/250-volt ditto.

THE CALEDON ELECTRICAL CO.,
2, Oswald Street, Glasgow. 5739

FOR SALE.

"BILGRAM" No. 3 Semi-automatic Bevel Gear Planing Machine, for gears up to 29½ in. diam.

Geared Motor-driven Duplex Screwing Machine, by Dron and Lawson, with dies up to 2½ in. diam.

Richards Patent Piston-Rod Grinding Machine, take rods up to 4 ft. 9 in. long.

18-in. stroke Geared Slotting Machine, with quick return motion.

6-ft. arm Universal Radial Drilling Machine, by The Niles Tool Co.

Six-spindle Drilling Machine, by Butler & Co., 1½-in. spindles, independent action to each spindle.

Powerful Double Standard Slot Drilling Machine, with 3-in. vert. spindle.

Rack-driven Planing Machine, to plane 6 ft. by 2 ft. 6 in. by 2 ft. 6 in., one tool-box.

Side Planing Machine, by Geo. Richards, Broadheath, on bed 9 ft. long.

Vertical Boring and Turning Mill, by Sellars & Co., Philadelphia, table 5 ft. 6 in. diam., swing 84 in.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS. Free on Application. Inspection invited.

THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,

and at Milburn House, Newcastle-on-Tyne.

Tel.: { 44 Wakefield. / 867 Newcastle. } Telegrams: "Engineer, Wakefield."

FOR SALE.

ONE Parsons Steam Turbo Set, 3500-KW., 1200 R.P.M., with alternator field-rotating type and exciter complete; 6000-volt maximum load, 40 cycles; condensers and three-throw type air-pump, driven by three-phase motor.

350-KW. Alternator, by the B.T.H. Co., 550 volts, 3-phase, 50 cyles, with Barclay's cross compound horizontal Engines, 26" and 40" cyls. × 4-ft. stroke.

Two Westinghouse Motor-Generators, Motors, 300 H.P., 480/500 volts, 3-phase, 40 cycles, Generators 200 KW., D.C., compound wound, 480/500 volts. Each set on separate soleplate.

200-KW. Generating Set, Engine by Belliss & Morcom, Ltd., cyls. 8" and 14" × 9" stroke, and Siemens Dynamo, compound wound, 380 R.P.M.

One 260-KW. 3-phase Westinghouse Alternator, 2200 volts, 25 periods, and Willans & Robinson 3-crank compound central-valve Engine.

SELECTION OF MOTORS IN STOCK.

300-H.P. Motor, by Sandycroft, 220 volts D.C., 130 revs. per minute; 175-H.P. Motor, Phœnix Company, 440 volts D.C.; 170 H.P. Motor, by A.E.G., 200-220 volts D.C., fitted ball bearings; 160-H.P. Motor, by A.E.G., 200-220 volts D.C.; 125-H.P. Motor, by E.C.C., 440 volts D.C.; 125-H.P. Motor, by Mather & Platt, 200-220 volts D.C.; 100-H.P. Motor, by Jackson, 440 volts D.C.; smaller sizes, down to 1 H.P., also in stock, together with Steam Generating Sets, Engines (steam, gas and oil), Dynamos, Pumps, and high-class plant of every description. Open for inspection at our Works at any time.

HARRY H. GARDAM & CO., LTD.,
Telegrams: "Gardam, Staines." Staines. 5681

FOR SALE.—*Continued.*

FOR SALE.

TEN "ECONOMIC" DRY BACK BOILERS, by Davey, Paxman and Co., 14' 6" long by 9' 9" dia., 160 lbs. working pressure.
Two GREEN'S ECONOMISERS, 180 and 220 pipes.
3-TON ELECTRIC LOCO. CRANE, 4' 8½" gauge, driven by 40-H.P. Motor.
30-TON OVERHEAD ELECTRIC CRANE.
THREE "PEARN" STEAM PUMPS, capacity 8000 gallons per hour.
TWO MOTOR-DRIVEN THREE-THROW BLAKE & KNOWLES PUMPS.
FOUR GENERATING SETS, comprising Vertical Compound Engines, by Musgraves, and D.C. Generator, by G.E. Co., 800 KW.
ONE GENERATING SET, comprising "Peache" Engine, 9" and 15" cylinders by 10" stroke, direct-coupled to D.C. Generator, by G.E. Co., 180 KW.
FOUR "WHEELER" CONDENSING PLANTS, each capable of dealing with 20,000 lbs. steam per hour.

Apply—
JOHN JACKSON & CO.,
Scotstoun, Glasgow. 5684

A.C. MOTORS, three-phase, 50 cycles, 400/650 volts, 10, 25, 30, 40, 50, 60, 80, 100, 115 H.P.
TRANSFORMERS, three-phase, 50 cycles, 6000/440 volts, 70, 100, 200, 250 KW., with switchgear.
D.C. MOTORS, 100/500 volts, 2½ to 250 H.P.
C. L. TURNER, 49, Deansgate, Manchester. 494

Cheap prepaid Advertisements relating to second-hand goods and specified Articles are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.

TRADE RATES ON APPLICATION.

Box Number and ELECTRICAL REVIEW address count as seven words.

CABLE, new; best English make, 3/19, 7/19.—LAKE, 132, Upper Thames Street, London. 5761

CARBONS, cored, 30 and 33 m/m, cheap.—LAKE, 132, Upper Thames Street, London. 5758

COMPLETE Lighting Plant, comprising Gas Producer, Engine; Generator (Siemens), 55 amperes, 135 volts; 54-cell "D.P." 17-plate Battery; Switchboard; Motor-Generator (Siemens), 460 volts—110/140 volts; Pump Motor, 3 H.P.; Starters and Regulators. —Full particulars on application, 514, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMO, 18-H.P., 250 volts, cheap.—LAKE, 132, Upper Thames Street, London. 5760

DYNAMO, 120 amps., 220 volts, 600 revs., by General Electric, with elaborate switchboard.—MARTINS, 320, Witton Road, Birmingham. 493

DYNAMO, 450 amps., 110 volts, 700 revs., compound.—MARTINS, 320, Witton Road, Birmingham. 492

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts, ready for delivery; also smaller sizes delivered from stock. Machines let out on hire.—CANNING & Co., Electro-Platers' Engineers, Birmingham. 7769

FOR Sale, 9-KW. Transformer, 205 to 15 volts, £15.—472, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Switchboard for two 50-KW., 220-volt Generators and Distributing Circuits, £25; seen in London.—473, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, five ¾-KW. and two 3½-KW. Flash-testing Alternators, cheap.—MARTINS, 320, Witton Road, Birmingham. 411

FOR Sale, 600-KW. Steam Alternator, Browett Triple-expansion Engine, D.C., three-phase, 50-cycle, 500 volts.—WILLIAMS AND SONS, 37, Queen Victoria Street, London. 5751

FOR Sale, 40-B.H.P. Diesel Vertical Single-cylinder Oil Engine, "Warme Patent," nearly new. Can be seen fixed as left off work. Cheap to save removal.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 5752

FOR Sale, 50-H.P., 110-volt, 4-pole, Shunt-wound Motor and Starter, £90.—422, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale or Hire high class Dynamos, Motors, Alternators, Cable and Arc Lamps.—PERCY HUDDLESTON & Co., 72, Finsbury Pavement, E.C. 460

FOR Sale, New Insulation Testing Set, by Kelvin & White; £10 for quick sale.—420, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, "Belliss-Crompton" Generating Set, 90 KW., 110 volts; £220.—421, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 500-volt Motor Starters; 12 H.P., £3; 25 H.P., £6.—424, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, large quantity Single, Double and Triple-pole Knife Switches up to 1000 amperes capacity. Direct and Alternating Current Ammeters, Voltmeters, Wattmeters, &c. Over 4000 lots miscellaneous Electrical Apparatus.—PHŒNIX ELECTRICAL Co., 40, Broomielaw, Glasgow. 425

FOR Sale, 8-H.P. Motor, enclosed, by Parker, C.C., 400 volts, 250 R.P.M. with half coupling.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 5691

FOR Sale, 30-KW. Generating Set, Belliss engine, direct coupled to a Crompton C.C. dynamo, 100 volts, 300 amps., 400 R.P.M. —WILLIAMS & SONS, 37, Queen Victoria Street, London. 5692

FOR Sale, 120-KW., D.C. Generator, belt drive, 100/120 volts, 1000 amps., 350 R.P.M., low price. — WILLIAMS & SONS, 37, Queen Victoria Street, London. 5693

FOR Sale, 40-KW. Willans-Siemens Generating Set, 100/130 volts, 430 R.P.M., low price. — WILLIAMS & SONS, 37, Queen Victoria Street, London. 5694

FOR Sale, 20-KW., 230-volt Exciter, suitable for rope or direct drive.—Apply, E. H. EDWARDES, General Manager, South Lancashire Tramways, Atherton, Lancs. 5753

GAS-Engine Generating Set, direct coupled, 65-KW., 500 volts, suitable for town or producer gas; engine 85 H.P., Stockport; dynamo by Westinghouse. Would sell engine and dynamo separately. Very low price and ready for immediate delivery.—JENNINGS, West Walls, Newcastle-on-Tyne. 5520

HOLMES Motor with starter, 3 H.P., 185 volts, 700 revs., and several Motor-Generators, cheap.—LAKE, 132, Upper Thames Street, London. 5757

MOTOR-Generators, 480 volts, D.C., to 60 volts, 60 a., Westinghouse; also one 220 volts, D.C., to 110 volts, 30 a., new.—SUGDEN, Wakering Road, Barking. 414

ONE 4-pole Shunt Motor, 450 volts D.C., 650 R.P.M., P. R. Jackson and Co., complete with slide rails, new starter, double-pole switch and fuses, no pulley, spare armature, 25 H.P.—L. E. WILSON AND Co., 10, Corporation Street, Manchester. 5729

PRACTICALLY New Motor Generating Set, composing Motor, 230 volts, D.C., coupled to Dynamo, 60 volts, 70 amps., 1150 revs., by Newtons, Ltd.; two Control Panels or Series Regulators, 20 and 12 H.P. for 440 volts, D.C., makers Bray, Markham & Reiss.—Apply STANLEY ENGINEERING Co., Bath. 513

SWITCHBOARD Panel, angle-iron box frame carrying slate slab, mounting one Kelvin Voltmeter, 3000 volts; Ammeter, 30 amps., D.P.; loose-handled overload Oil Switch; two large S.P. Porcelain Fuses. Separately A.C. Ammeter, 400 amps.; ditto, D.C., 500 amps.; and Everett, Edgcumbe Synchroniser.—413, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THREE-Phase Motor, 10-H.P., 400 volts, 50 cycles, 1,400 R.P.M., Complete pulley, rails, starter; in new condition. £38. By the Electrical Co.—BOYS, Featherstone Buildings, Holborn, W.C. 475

TWO 1-H.P., 220-volt D.C., 800 rev. Motors, nearly new, in perfect running order, price £4 each, complete with starters. One 1-H.P., 440-volt D.C., 1000 rev. ditto, price £3, no starter.—JANDUS ELECTRIC Co., LTD., Hartham Works, Holloway, London. 5731

6-H.P. 1350 R.P.M., 4-H.P. 1000 R.P.M., 3-H.P. 1000 R.P.M., 1¼-H.P. 1200 R.P.M., 1-H.P. 1450 R.P.M., ½-H.P. 1050 R.P.M., for 400/480 volts D.C. 5-H.P. 1050 R.P.M., 3-H.P. 1200 R.P.M., 1-H.P. 930 R.P.M. 1-H.P. 1200 R.P.M., ½-H.P., ¼-H.P., ⅛-H.P., for 200/250 volts D.C. All nearly new.—BOYS, Featherstone Buildings, Holborn, W.C. 478

20-H.P. G.E.C. 220-volt motor, 1150 R.P.M.—MARTINS, 320, Witton Road, Birmingham. 517

60-H.P. Motor, 460 volts, D.C., 680 R.P.M. compound, with starter; also several smaller.—SUGDEN, Wakering Road, Barking. 415

200-KW. Generating Set, Belliss & Morcom three-crank six-cylinder Engine, coupled direct to Parker Dynamo, 210 volts, 900 amps., 420 revs., Switchboard and new spare armature. Seen fixed in London for next few days.—JOSEPH PUGSLEY, 72, Queen's Circus, Battersea Park, London, S.W. 9964

250-KW., 500-volt Generating Set for Sale, Belliss Engine.—Specification and price on application to 423, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BUSINESSES FOR SALE AND WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ELECTRICAL Business for Sale in northern suburb. Stock about £150. Goodwill and fittings £100, or near offer. Good connection. Accountant's figures.—Write, D. E., c/o J. W. Vickers & Co., Ltd., 5, Nicholas Lane, E.C. 508

ELECTRICAL Contracting Business, S.W. of England, for Sale, cheap, owing to both partners having joined the Army.—457, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARTICLES WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone, Dalston, 555. Telegrams, Secondhand, Lowclap, London. Established 1860. 42

A.C. and D.C. Motors (second-hand) any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 106

A. LEAROYD & Son, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of secondhand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 107

ALL kinds of disused Plant, Machinery, Scrap Metals, &c., purchased for cash. If you have any Generating Sets, Motor Dynamos, Steam Engines, Boilers, &c., you wish to dispose of, kindly offer same to us. Complete works purchased for dismantling.—HARRY H. GARDAM & Co., LTD., Staines. Telephone, Staines 98. 8579

DYNAMO wanted. 100 v. D.C., 15-20-25 H.P. State makers, No., age, type. — 502, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or machinery, purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 417

LAMP Caps (used), bayonet pattern, required. State delivery and price for cash down.—507, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OIL Engine, about 18 to 20 H.P.; Dynamo, 100/140 volts, 90 amps.; Standard Battery Switchboard, 100 amps.; wanted immediately.—State full particulars, 518, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OLD Electric Lamp Tops, any make; scrap Platinum, Mercury, old Gold, Silver, broken Watches, old False Teeth, old Jewellery in any condition; old Cable and scrap Metals of every description purchased in any quantities at highest prices by J. LEE AND Co., 56, Green Street, Bethnal Green, London. Call or send; cash returned immediately as goods received. 407

PLATINUM in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

REQUIRED, three 200-kilowatt Generating Sets, 450 to 550 volts, alternating current, coupled to up-to-date high-speed engine. State fullest particulars and lowest price to C. R. O., Box 705, c/o, 5, Queen Victoria Street, E.C. 509

SURPLUS Stocks Electric Cable, Plant, &c., bought for cash; also Scrap Cable, old Dynamos, Motors, Cells, Scrap Metals, Lamp Ends, &c. - LAKE, 132, Upper Thames Street, London, E.C. 5759

WANTED, 3-phase, 25-cycle, 400/440-volt, Induction Motor, of about 80-130 H.P. and 450-500 R.P.M.; also starting and control gear.—468, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 50/100-KW. Steam Generating Set, D.C., 230 volts, prompt delivery.—Particulars to WILLIAMS & SONS, 37, Queen Victoria Street, London. 5750

WANTED, High-speed, Vertical, Direct-coupled Generating Sets, consisting of Belliss, or equal make of compound or triple-expansion engine direct coupled to multipolar dynamo. Output approximately 300 to 400 KW., speed about 350 R.P.M. Offers are invited for two 300-KW. sets at 230/250 volts, shunt-wound, and one 300-KW. set, 500 volts, shunt-wound. Prices to include loading up f.o.r.—5756, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, old Telephones and Apparatus, suitable for repairing others. Cash.—POWER, Wormald Row, Leeds. 399

WANTED, Steam Generating Set, 50/100 KW., 200 v., 2-phase, 50 cycles, or 50/100 KW., 200 v. D.C. Must be in good condition.—5675, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 300-amp., 220 Generator; 60 KW. 2-phase Steam Set; 1000-amp., 110 Generator; few Motors; in first-class condition.—MARTINS, 320, Witton Road, Birmingham. 412

WANTED, Generating Sets, all sizes, Boilers, Accumulators, Dynamos, &c., for export; also Scrap Cable and Metals. Complete plants purchased.—WILLIAMS & SONS, 37, Queen Victoria Street, London. Telephone, 3938 City. 7000

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

WANTED, one 150/200-KW. D.C. Generator, compound wound, 550 volts, 250 R.P.M. for direct driving; complete with outboard bearing and half coupling. Must be in good condition and of first-class make.—Reply giving price and full particulars, to J., Box 712, c/o 5, Queen Victoria Street, London, E.C. 520

WANTED, modern Dynamo, 100 to 110 volts, 40 amps., shunt wound.—STANLEY ENGINEERING CO., Bath. 512

WANTED, Plating Dynamo, by good maker, to give 750 amperes at 10 volts.—500, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED urgently, vertical engine, 90 lbs. with dynamo, D.C., 30 KW., 220 volts, good condition.—499, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

750,000 Old Electric Metal Filament Lamps wanted with bulbs and caps complete.—Quote lowest prices, and number you have for sale, by letter, to 510, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MISCELLANEOUS.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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ELECTRIC Motor repairs of all kinds. Temporary motors loaned. Preference given to orders from Government contractors.—E. P. ALLAM & CO., 107, Gray's Inn Road, W.C. Holborn 1280. 248

ENGINEERS having well equipped Machine, Fitting, Brass Finishing, Instrument and Assembling Shops in S.W. London, are anxious to secure additional manufactures, either Class A or competitive to foreign imports.—Write 5629, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS for Hire.—5-H.P. Electric Motor, driving two lathes, drilling machine, various other tools and materials, power-driven circular wood saw, &c.—GREENLY, 37, Strand. 524

Where Advertisements are to be answered to a given number at the ELECTRICAL REVIEW Office, Applications for names and addresses of the Advertisers will be entirely disregarded, and Letters giving incorrect Box Numbers will be destroyed.

NOTICES RELATING TO PATENTS.

Latest time for receiving 9.30 a.m. Thursday.

John E. Raworth,

Queen Anne's Chambers, 28, The Broadway, Westminster, S.W. **Chartered Patent Agent.**

THE PROPRIETORS of the Patents Nos. 15951 of 1913, 10868 of 1914, for "Improvements in Safety Devices for Electric Conductors," and "Improvements in and relating to Electrical Condensers and the Process of Manufacture thereof," are desirous of entering into arrangements by way of licence and otherwise, on reasonable terms, for the purpose of exploiting the same and ensuring its full development and practical working in this country.
All communications should be addressed in the first instance to
HASELTINE, LAKE & CO.,
Chartered Patent Agents,
28, Southampton Buildings, Chancery Lane, London, W.C. 5699

ELECTRICAL REVIEW.

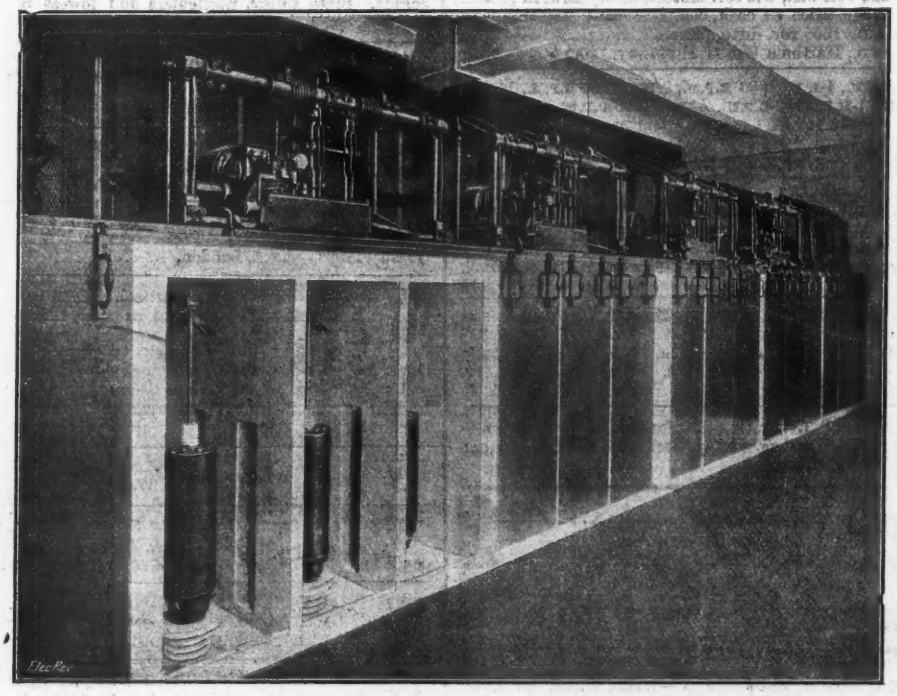
BINDINGS AND CASES.—Subscribers and others can have their half-yearly numbers bound handsomely in Black Cloth at the rate of 4s. per volume. Cases for binding are also supplied at 2s. 6d. each.—4, Ludgate Hill, London.

NOTICE.

OWING to the many hundreds of replies passing through this Office each week, we would ask those answering Advertisements to be EXTREMELY ACCURATE with regard to the figures WHEN ADDRESSING REPLIES to Box Numbers.

ADAMANT CELLWORK FOR

High Pressure Oil Switches



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WILL NOT ABSORB MOISTURE.

MECHANICAL STRENGTH HIGH.

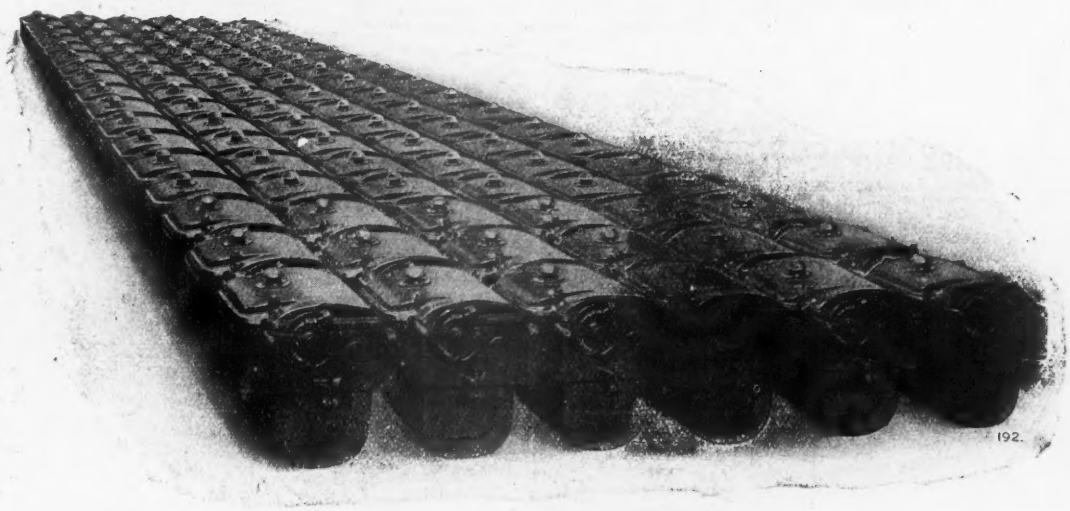
ACCURATE FINISH AND DIMENSIONS.

The CROFT GRANITE, BRICK & CONCRETE CO., LTD.,

Nat. Tel.: 48 NARBOROUGH. CROFT, near LEICESTER. Tels.: ADAMANT, CROFT, LEICESTERSHIRE (two words).

"ELLISON"

TOTALLY ENCLOSED OIL-BREAK STAR-DELTA STARTER WITH FULL AUTOMATIC FEATURES.



PART OF ONE ORDER FOR OIL-BREAK STAR-DELTA STARTERS.

ABSOLUTELY "MISTAKE PROOF."

SEND FOR LIST No. 121.

GEORGE ELLISON,

LONDON: QUEEN ANNE'S CHAMBERS, WESTMINSTER.

MANCHESTER: 4, CANNON STREET.

VICTORIA WORKS, WARSTONE LANE,

BIRMINGHAM.

SHEFFIELD: INDEPENDENT BUILDINGS, FARGATE.

GLASGOW: 221, ST. VINCENT STREET.

NEWCASTLE: 90, PILGRIM STREET.

THE ELECTRIC TRAMCAR HAND-BOOK,

For Motormen, Inspectors and Depot Workers.

By W. A. AGNEW.

1s. 6d. *Post Free* ***1s. 8d.***

H. ALABASTER, GATEHOUSE & CO., 4, Ludgate Hill, LONDON, E.C.

JACKSON ELECTRIC HOT-PLATE. No. 210.

Made of stout sheet copper. Polished or nickel-plated. Fancy feet. Heat insulated handles. From £2 13s. 0d.

Why not Approach

Hotels, Public Institutions, etc., in your district on the question of Electric Cooking and offer your advice and assistance? We will lay ourselves out to help you in any and every way.

JACKSON ELECTRIC STOVE Co., Ltd.,

38, BLANDFORD STREET, LONDON, W.

Telephone: MAYFAIR 996. Telegrams: "COOKELEC BAKER LONDON."

THE
ELECTRICAL SUPPLIES
COMPANY
PROPRIETORS THE
E.S.Co LTD.

Here is a genuine opportunity to do more profitable business.

GUARANTEED TEN YEARS.

Hotpoint Electric Irons.

STOCKED IN 3 SIZES: 3, 5, & 6 lbs.

NOTE THESE POINTS.

1. Hot-point (hottest part of the iron).
2. 10-year guarantee.
3. Sound electrical and mechanical construction.
4. Attached stand.
5. Finish, shape, and cool handle.
6. Fool-proof connector and special flex (which overcome the usual troubles).

SIX SPECIAL FEATURES.

THE "LIGHT HOUSE,"
233, TOTTENHAM COURT RD., LONDON, W.
TELEPHONE: MUSEUM 2516-7. TELEGRAMS: "ELECSPLICO OX, LONDON."
MANCHESTER DEPOT: 40, VICTORIA BUILDINGS. PHONE: CITY 5794.

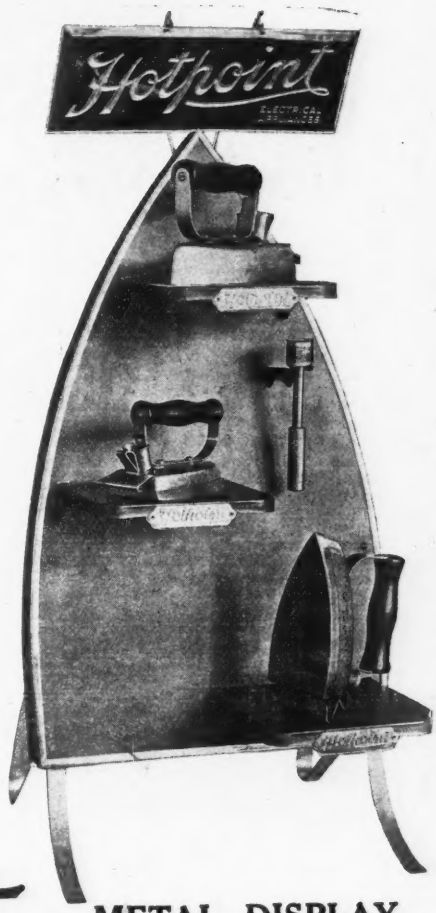
THE
ELECTRICAL SUPPLIES
COMPANY
PROPRIETORS THE
E.S.Cº LTD.

This is our unique offer:

Upon receipt of your Sample Order for 12 (one dozen) HOTPOINT IRONS (assorted sizes) we will supply FREE OF COST One METAL DISPLAY STAND—40 inches high—for your Window or Showroom, or a "Whirling Display" and other Advertising Material.

As soon as a woman sees the six Special Features and the 10 years' guarantee of HOTPOINT IRONS —she'll buy.

So you'll quickly sell the first dozen and order another.



Hotpoint Electric Irons.

Retail at 15/5 nett (all sizes). This price includes 2¼ yds. of special flex and connector.

METAL DISPLAY STAND.

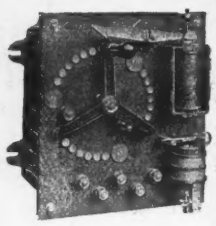
The handsomest display stand in the trade

IS FREE

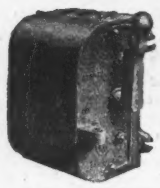
on your complying with the simple terms of our generous offer.

Liberal Terms to the Trade.

THE "LIGHT HOUSE,"
233, TOTTENHAM COURT RD., LONDON, W.
TELEPHONE: MUSEUM 2516-7. TELEGRAMS: "ELECSPLICO OX, LONDON."
MANCHESTER DEPOT: 40, VICTORIA BUILDINGS. PHONE: CITY 5794.



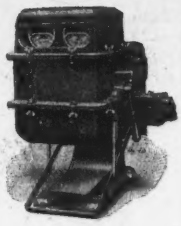
Double Automatic Air-Break Starter.



Air-Break Drum-Type Starting Switch.

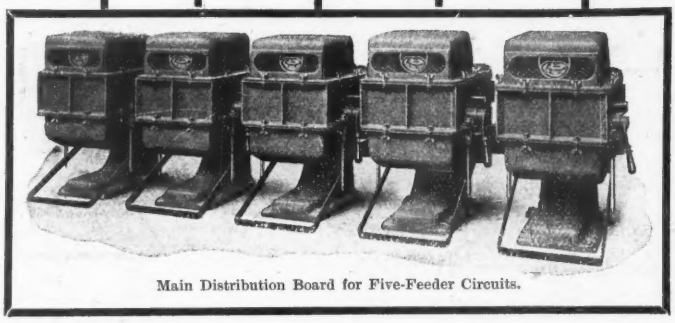
Ironclad Oil-immersed Motor Control Unit.

Oil-immersed Starter.



Oil-immersed Switch Pillar.

By adopting E.A.C. Alternating-Current Apparatus you will obtain one standard make of Switch and Motor-Control Gear right through your installation from main distribution board down to each motor control equipment.



Main Distribution Board for Five-Feeder Circuits.

The E.A.C. Drum-Type A.C. Motor Control Gear possesses several novel features which will be of interest to all installation engineers.

We will send full particulars on request.

The Electrical Apparatus Company, Limited,

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BIRMINGHAM: Carlton House, High Street.

HEAD OFFICE AND WORKS: Vauxhall Works, South Lambeth Road, London, S.W.

MANCHESTER: Palatine Buildings, Victoria Street.

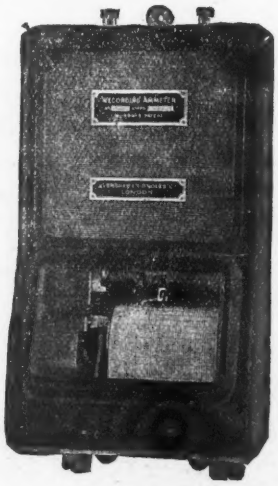
NEWCASTLE-ON-TYNE: 25, Eldon Square.

DUCTER MEGGER DUCTER MEGGER DUCTER MEGGER DUCTER

BUY NO OTHER

before you have examined the unique features of the

Murday Recorder



You will certainly buy no other after you have done so.

List 113 will tell you all about it; post free on application.

Sole Makers: EVERSHED & VIGNOLES, Ltd.,

Telephone: 1370 Chiswick (2 lines).
Telegrams: "Dorothea, Chisk, London."

Acton Lane Works, Chiswick, LONDON, W.

OFFICIAL NOTICES.

Latest time for receiving 9.30 a.m. Thursday.

COMMONWEALTH OF AUSTRALIA.

POSTMASTER-GENERAL'S DEPARTMENT,
April 11th, 1916.

TENDERS are invited up to August 16th, 1916, for the supply to the Postmaster-General's Department, State of Western Australia, of (*a*) Distilling Apparatus to Schedule No. 502, and (*b*) Instruments, Telegraph and Measuring—various and parts, to Schedule No. 498.

Tender Forms and Specifications may be obtained at the Commonwealth Offices, London.

WILLIAM WEBSTER,
Postmaster-General. 5621

PLYMOUTH CORPORATION.

THE PLYMOUTH CORPORATION is prepared to receive tenders for a Rotary Steam Boiler Feed Pump.

Specification and form of tender may be obtained from the undersigned after deposit of 20s. per copy, which will be returned after receipt of *bona-fide* tender.

Sealed tenders, endorsed "Contract No. 33," to be delivered to the undersigned before 12 noon, THURSDAY, JULY 20th.

E. G. OKELL,
Borough Electrical Engineer.

June 28th, 1916. 5747

F. WIGGINS & SONS.

MICA FOR INSULATION.

Telephone. Avenue 2248

Largest Stock in the World.

102, 103 & 104, Minories, LONDON.

HOOPER'S

Telegraph & India-Rubber Works, Ld.

31, LOMBARD ST., E.C. *(Established 1860.)* | MILLWALL DOCKS, LONDON, E.

PURE TAPE AND STRIP, &C., &C., | HOOPER'S Vulcanised India-Rubber Cables for Electrical Work maintain the highest quality, and their durability has been proved.

Telegrams: LINEAR, London. Telephone: 1169 Avenue & 84 East.

For Works *and Factories.*

The

SILICA LAMP.

What it is and what it does.

The Silica Lamp is different to all other types of illuminant in that it takes less current and gives a light which is naturally and perfectly diffused. It is specially suitable for works lighting because it gives a highly penetrative light without glare. You should know all about it if your are interested.

Write for a Copy

of List No. 573. It tells in few words all about this remarkable Lamp.

K265

The Westinghouse Cooper Hewitt Co., Ld., Specialists in Factory Illumination, 80, York Road, King's Cross, London, N.

1s. 6d. POST FREE 1s. 8d.

THE ELECTRIC TRAMCAR HAND-BOOK,

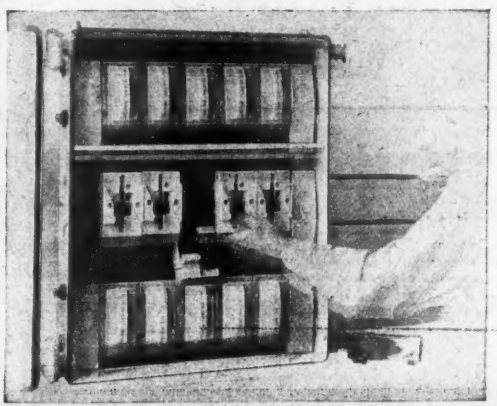
By W. A. AGNEW.

For Motormen, Inspectors and Depôt Workers.

H. ALABASTER, GATEHOUSE & CO., 4, LUDGATE HILL, LONDON, E.C.

The FLUVENT Fuse System (HOPE'S PATENTS).

Reg. Trade Mark.



for Power and Lighting Circuits.

SPECIAL POINTS:

NO heating troubles.
Will stand up to the worst conditions.
Every live part shielded.
Built up of Standard Units—all parts easily renewable.
Will clear circuit under the most severe short-circuit conditions.

Write for **NEW** CATALOGUE, now ready.

Deliveries 7–10 days under Class A.

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Hulme Electrical Works, MANCHESTER.

London Office: Queen Anne's Chambers, Westminster.
Scotland: David Alexander, Mains Street, Waterloo Street, Glasgow.
Telephones—Manchester: 1902 Central. London: 7265 Vic. Glasgow: 4394 Central.

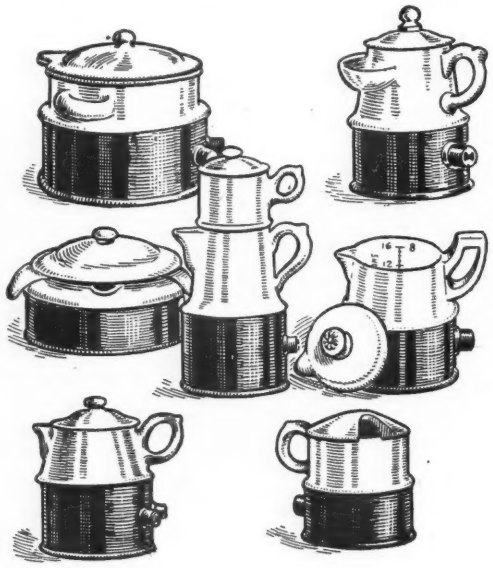
SAMPLE BOARDS CAN BE SEEN EITHER IN LONDON, MANCHESTER OR GLASGOW.

EDISWAN

(HOSGOOD)

STONEWARE COOKING UTENSILS.

There are so many inducements for the Trade to stock, and so many exceptionally good points in the line itself, that it becomes difficult to know which is **our** best selling point. **Your** best selling points are, however, amongst the following :—



Cleanest Cooking Utensils on the Market.

Every Article has More than One Use.

Exceptionally Handsome Appearance.

Really Economical.

Reasonably Priced.

Profitable Return.

Sell on Sight.

With the help we are prepared to give with Leaflets, Showcards, Blocks, &c., an exceptionally good selling line is awaiting you.

Please write to-day for Leaflet No. H3143. Or, better still,

'PHONE - - 520 ENFIELD,

OR ANY OF OUR BRANCHES THROUGHOUT THE KINGDOM.

The Edison & Swan United Electric Light Co., Ltd.

PONDER'S END, MIDDLESEX.

123-125, QUEEN VICTORIA STREET, E.C. (Special Show).

71, VICTORIA STREET, WESTMINSTER.

NEW LAMP DISCOUNT SCHEME.

NOTICE TO THE TRADE.

For the convenience of the Buyer of Drawn Wire Electric Lamps we have issued a Booklet which explains the new Selling Scheme. This covers the Terms at which we can supply

Siemens British Made

WOTAN,
HALF-WATT type
and
TANTALUM

Drawn Wire **LAMPS.**

A Copy will be supplied to any *bona fide* TRADE Customer on receipt of application.

SIEMENS BROTHERS DYNAMO WORKS Ltd.

38 and 39, Upper Thames Street,
London, E.C.

Telephone: City 5350 (Seven Lines).

Telegraphic Address: "Siemotor, Cent., London."

Or from the following Branch Addresses:

BIRMINGHAM: Central House, New St.
CARDIFF: 89, St. Mary Street.
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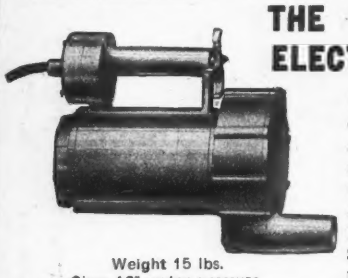

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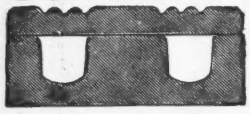

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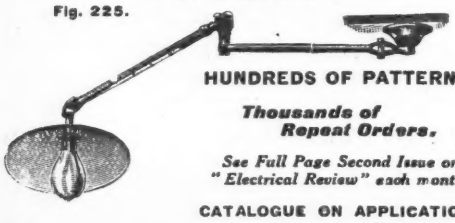

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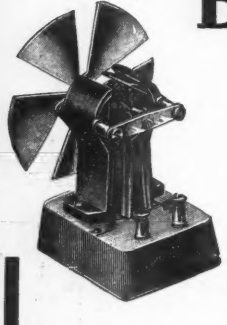

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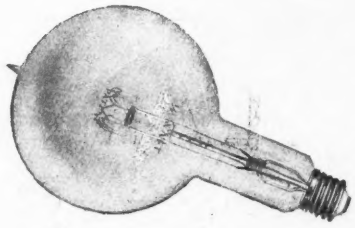

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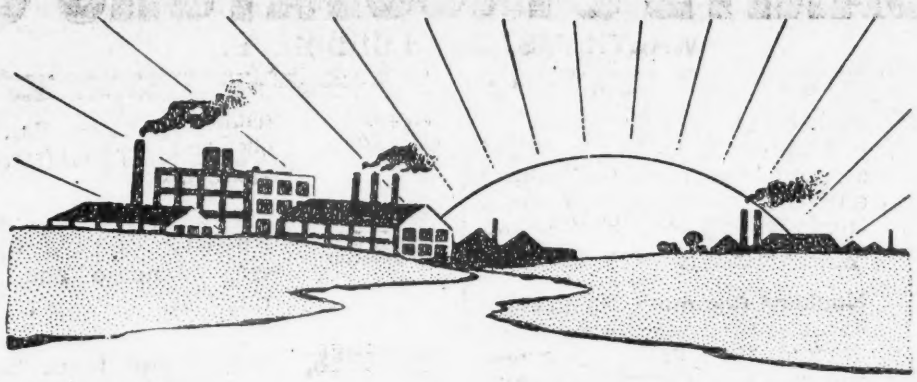

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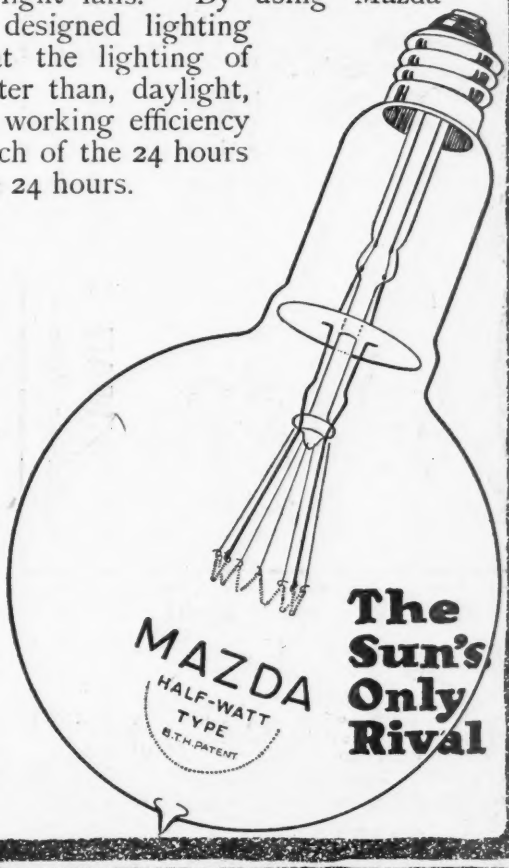

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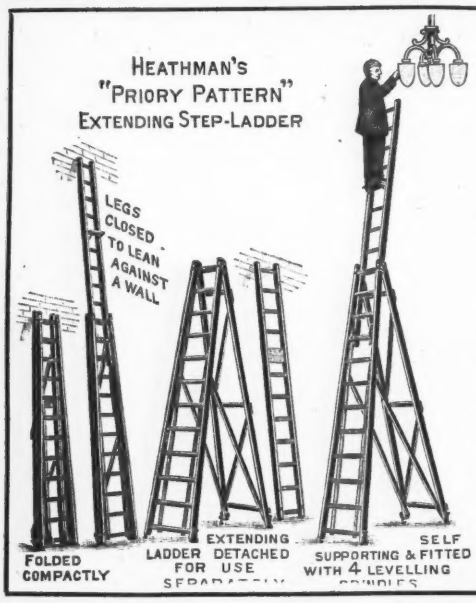
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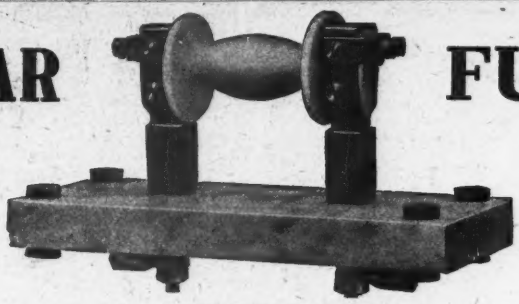

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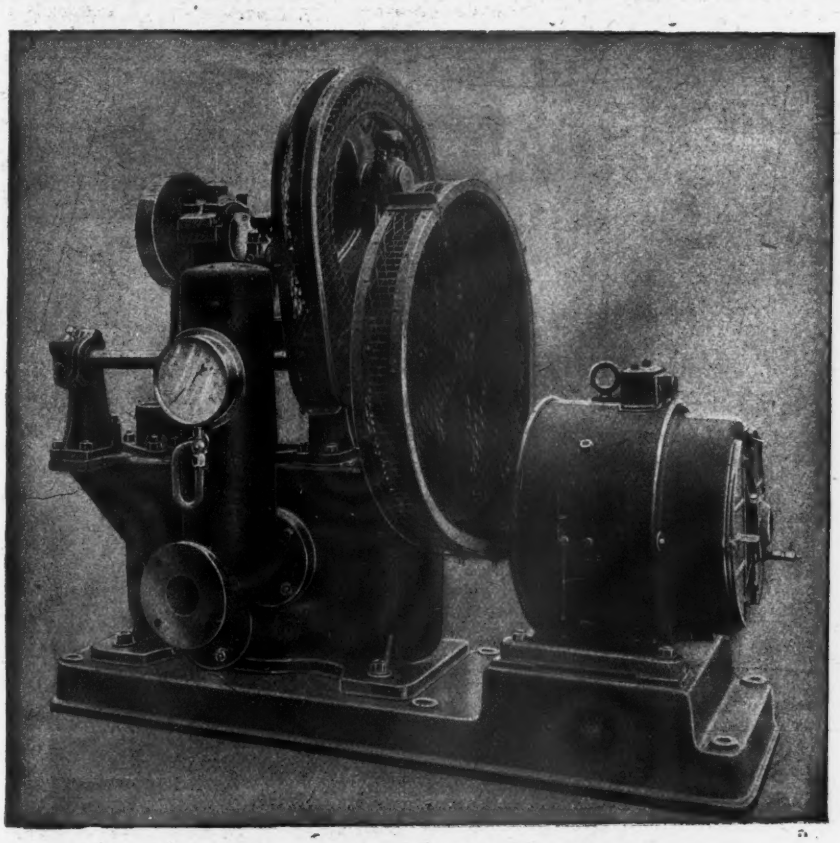

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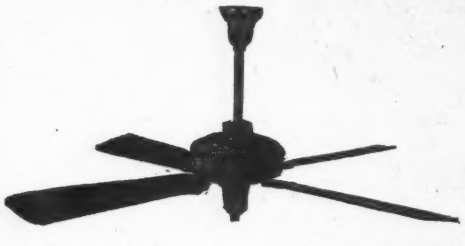

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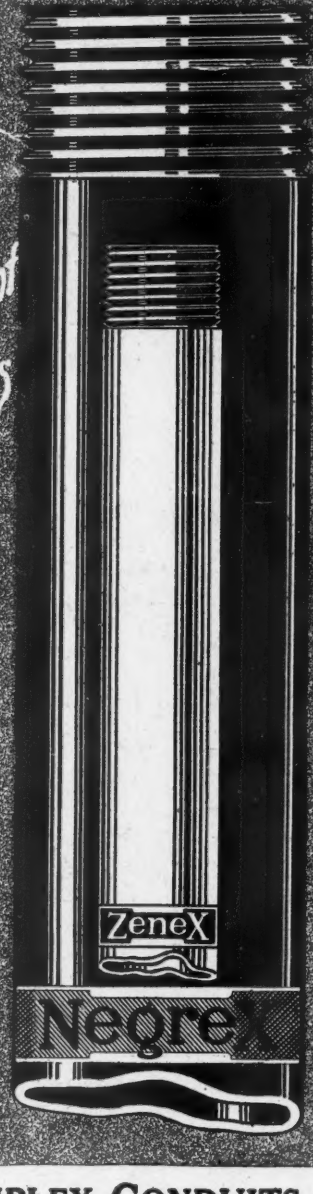

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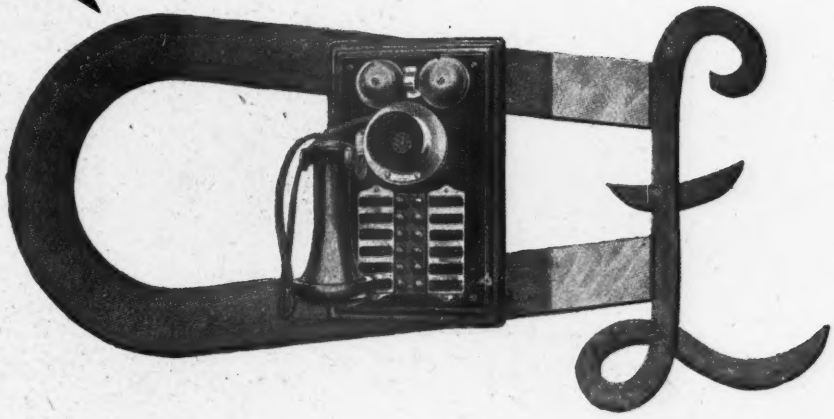

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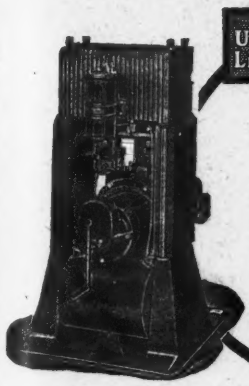

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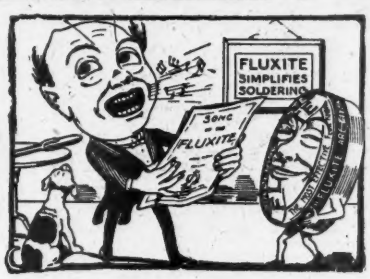

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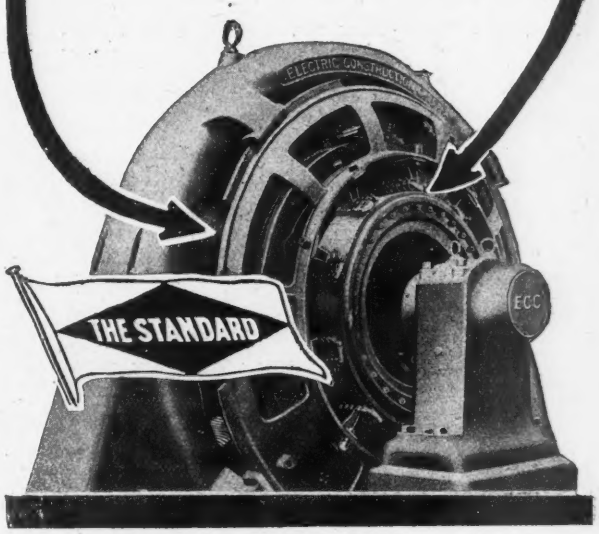

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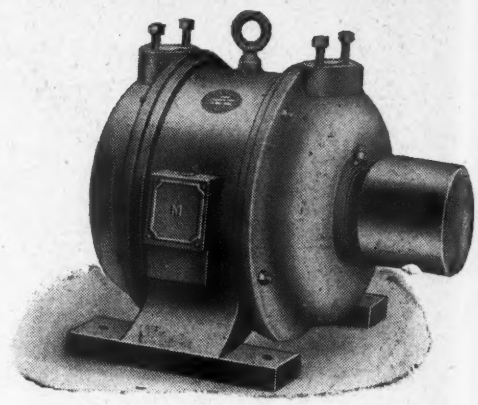

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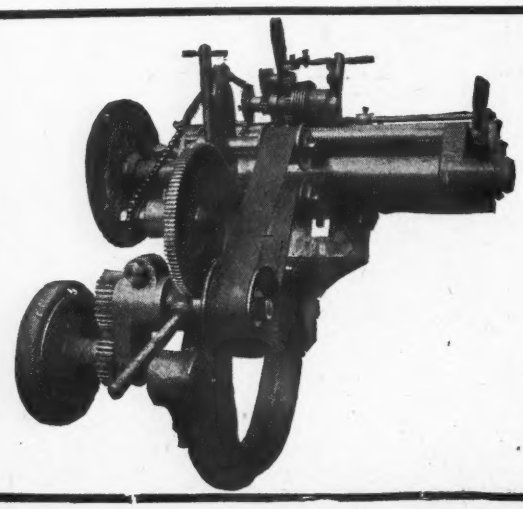

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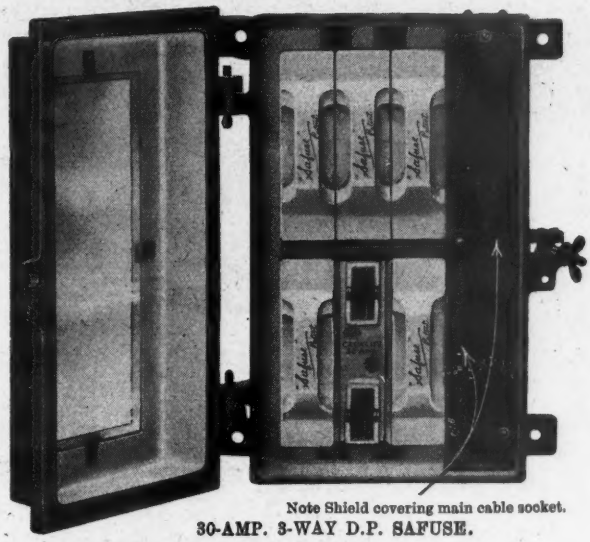

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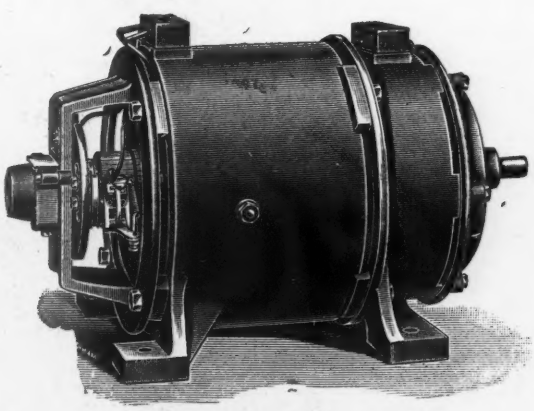

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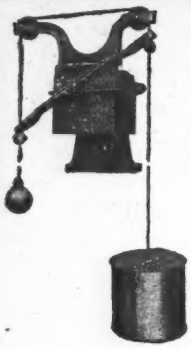

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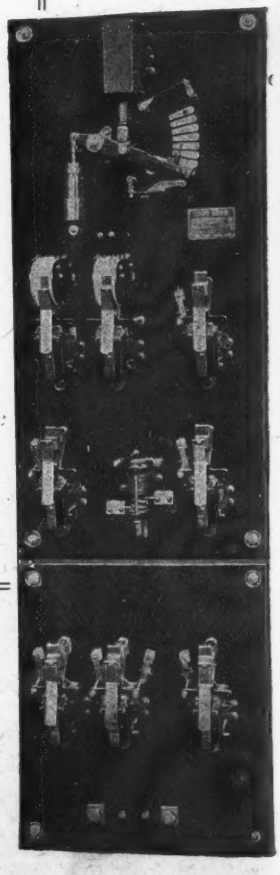

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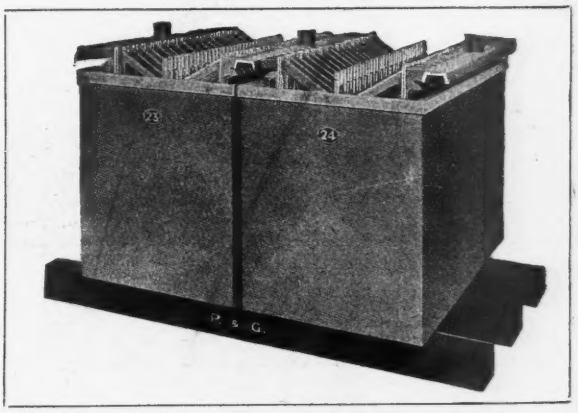

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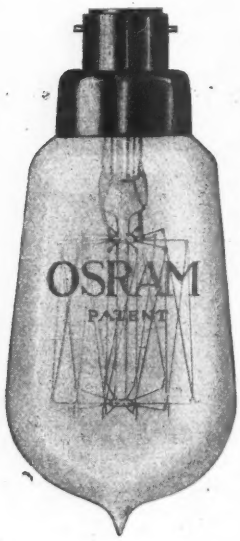

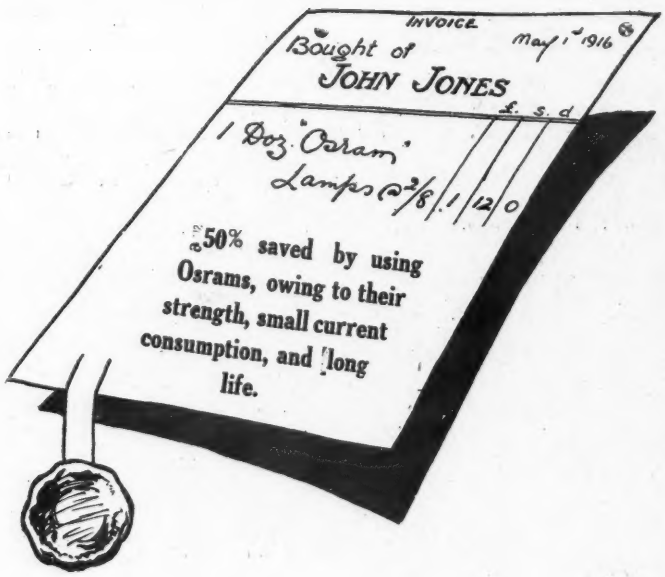
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[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Additions to engineering works, at 80, Spring Garden; W. McKinnon & Co., Ltd.

BACUP.—Premises, for the Spiritual Evidence Society; S. Carter, Corresponding Secretary.

BARNARD CASTLE.—Wesleyan Church at Lartington; Mr. Spence, Lartington Hall (donor of site).

BARNSTAPLE.—United Methodist Church, at Chapelton; Pastor.

BARROW-IN-FURNESS.—Rebuilding "Ferry" Hotel, Walney Island; the Licensee.

BURY.—Alterations to licensed premises; Crown Brewery Co.

CASTLEFORD.—Primitive Methodist Chapel, at Townville; Trustees.

CLIFTON (LANCS.).—Additions at pottery works; Pilkington Tile & Pottery Co.

DEWSBURY.—Building at Ravensthorpe Mills; Rawden, Briggs & Co., Ltd., Ravensthorpe Mills.

DORCHESTER.—Premises, High Street East, for C. H. Smith (several thousand pounds).

EGHAM.—Stores, &c., Victoria Street, for the Staines and Egham Co-operative Society.

EXETER.—Factory extensions, North Street, for Rowe Bros., Ltd.; J. Crocker, architect, 253, High Street.

FITZWILLIAM (YORKS.).—28 houses, for the Hemsworth & South Kirkby Collieries, Ltd.

FRINTON-ON-SEA.—Additions, "Waynflete," Winchester Road, for the Mother Superior of St. Joseph's Convent School.

GRANTHAM.—Premises, Watergate, for G. Whipple & Son (£20,000).

GUILDFORD.—Re-erection of premises, High Street, for C. A. & L. Gates.

HAYWARDS HEATH.—Alterations, "Hassocks" Hotel, for Mr. Beck.

HIGGINSHAW (NEAR OLDHAM).—Extensions, new offices, at Lamb Mills; Proprietors.

HIGH WYCOMBE.—Stores, Kitchener Road, for Broom & Wade, Ltd. Garage, Castle Street, for C. H. Hunt & Son.

HULL.—Additional accommodation at the Sailors' Orphan Homes, Newland (£10,000); T. Priestman, hon. secretary.

JARROW.—Alterations to premises, Railway Street; Marshall & Tweedy, architects, 17, Eldon Square, Newcastle-on-Tyne.

LEIGH.—Premises, for the Leigh Friendly Co-operative Society.

LINCOLN.—Warehouse, Monks Road, for Martin, Ltd. (£1,000).

LONDON (HORNSEY, N.).—Alterations to National Hall, High Street, and houses, Crouch Hall Road, Crouch End; J. Farrer, architect, 2, Coleman Street, E.C. Conversion of "South View," Alexandra Park Road, Muswell Hill, into V.A.D. Hospital; J. H. Taylor, Church End, Finchley, N.

(POPLAR, E.).—Office extension, Blackwall Yard, Brunswick Street, for R. & H. Green and Silley Weir, Ltd.

(HENDON, N.W.).—Stores, buildings, &c., Renter's Avenue, for Johnson & Sons. Extension, Bigwood Road, for Co-partnership Tenants, Ltd., 6, Bloomsbury Square, W.C.

LONDONDERRY.—200 houses, for the North of Ireland Shipbuilding Co., Ltd., Foyle Shipyard.

MERTHYR TYDFIL.—Garage, Troedyrhew, for the Merthyr Co-operative Society; T. E. Rees, architect.

MORRISTON (SWANSEA).—Business premises, for D. Mathias, Cross Stores.

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ST HELENS.—Rebuilding corn mill and stores in Tortire Street, for J. H. Berrey.

ST. HILARY (CORNWALL).—Residence, for A. Williams; H. Maddern, architect, 11, Morrab Road, Penzance.

SHEFFIELD.—Partial rebuilding "Viaduct" Inn, Wicker and Scholey Lane, for Duncan, Gilmour & Co., Ltd. Additions, Watery Meadow and Henry Streets, for the Masta Steel Works, Ltd. Additions, Brown Street, for J. J. Saville & Co., Ltd. Additions, Bind Street and High Street Lane, for W. Gunstone & Sons, Ltd. Additions, Russell and Bower Streets, for Moss & Gamble Bros. Alterations, Furnace Hill, for F. G. Pearson & Co., Ltd. Additions, Effingham Road, for G. Cooper & Sons, Ltd. Additions, West Bank Lane, for the Co-operative Wholesale Society, Ltd.

SOUTHAMPTON.—Building, Empress Road; A. F. Gutteridge, architect, 9, Portland Street.

SOUTH ELMSHALL (YORKS.).—Bakery, for Mr. Walker.

SOUTHEND-ON-SEA.—Additions, Leigh Road Baptist Church, for the Trustees. Additions, Stuart House, Trinity Avenue, for C. Mackay. Flats, Cliff Road, for R. Hunt. Bungalow residence, London Road, Leigh, for A. Hansford.

WALKDEN.—Electrical installations in mill extension; J. Booth & Co., Ltd., Bridgewater Mill.

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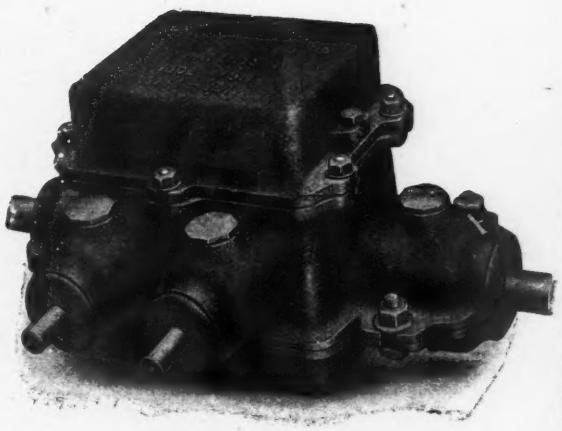

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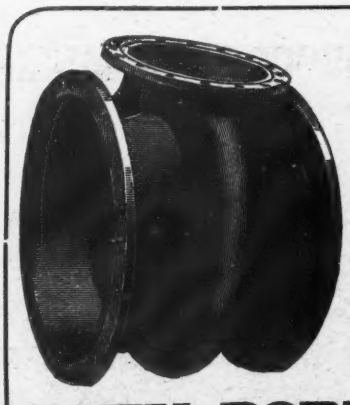

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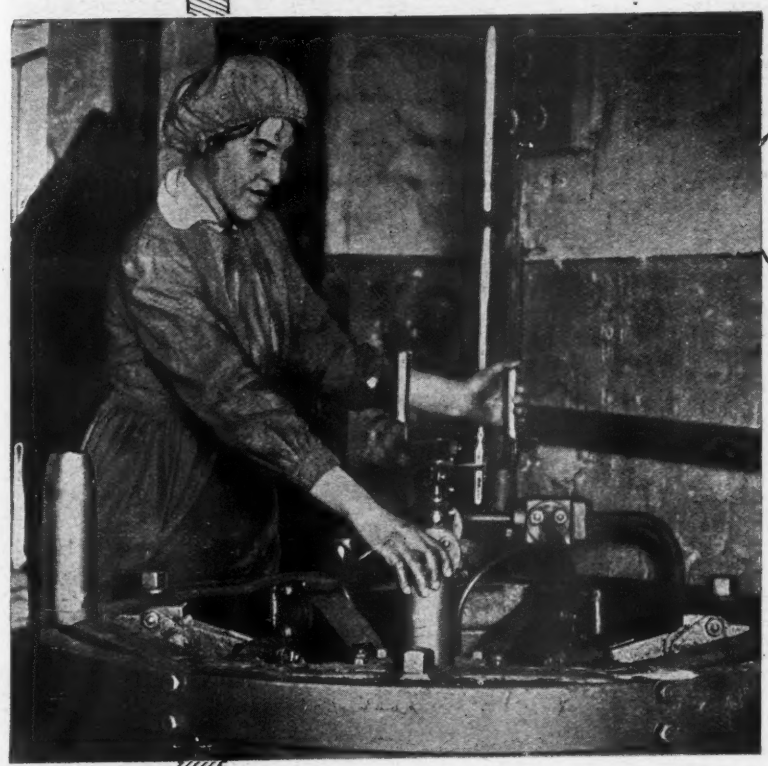

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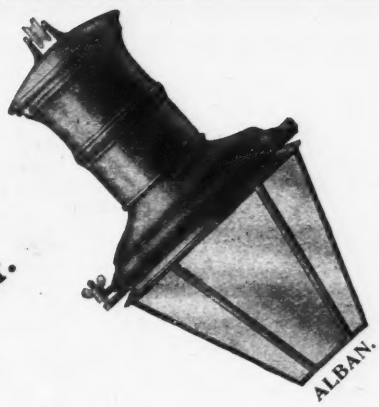

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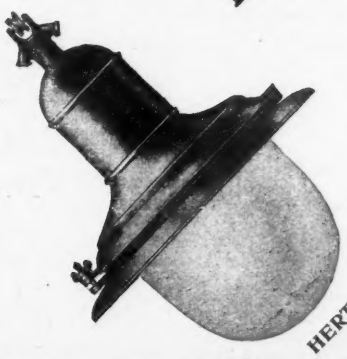

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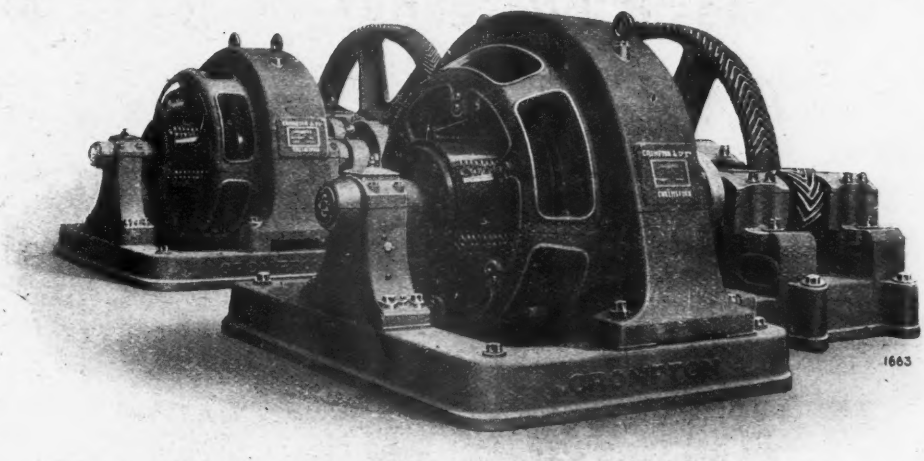

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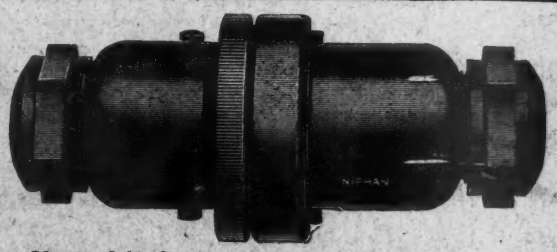

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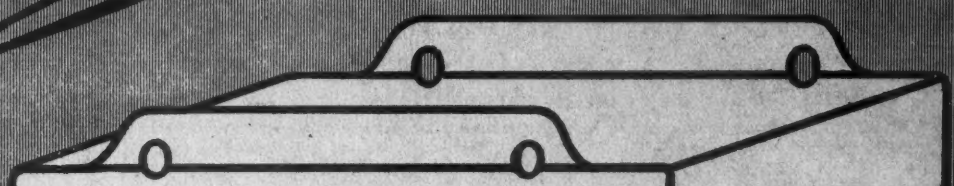

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